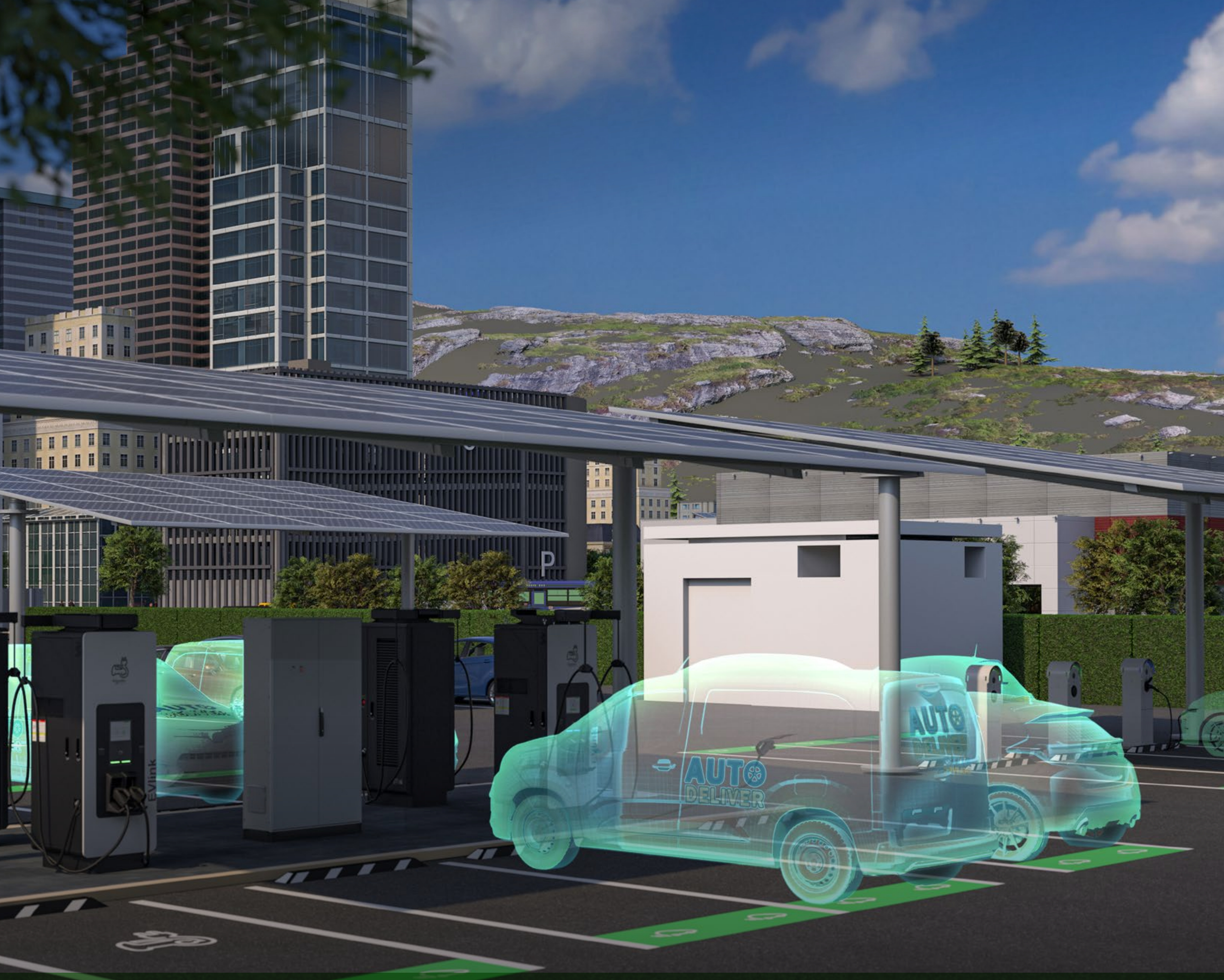



# eMobility Infrastructure Design guide for building applications

IEC Design Guide

06/2024

se.com/emobility

Life Is On Schneider Electric

# Legal and safety information

## Important Instructions

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it.

The following special messages may appear throughout this guide or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

**DANGER**

**DANGER** indicates a hazardous situation which, if not avoided, **will result in** death or serious injury. **Failure to follow these instructions will result in death, serious injury, equipment damage, or permanent loss of data.**

**WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, **can result in** death or serious injury. **Failure to follow these instructions can result in death, serious injury, equipment damage, or permanent loss of data.**

**CAUTION**

**CAUTION** indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.
**Failure to follow these instructions can result in injury or equipment damage.**

***NOTICE***

**NOTICE** is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.



All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform component repairs.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results. Failure to observe this information can result in injury or equipment damage.

***NOTICE***

**POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY**

- Change default passwords at first use to help prevent unauthorized access to device settings, controls, and information.
- Use cybersecurity best practices to help prevent unauthorized exposure, loss, modification of data and logs, or interruption of services.

**Failure to follow these instructions can result in a non-operational system where the Wireless Panel Server is installed.**

# Purpose of this Document

## Target Audience

This design guide is intended for certified EcoXpert partners, System Integrators, Specifiers, Electrical distribution designers, Installers, Electricians and other qualified personnel who are responsible for the design and definition of eMobility infrastructures.

## Objective

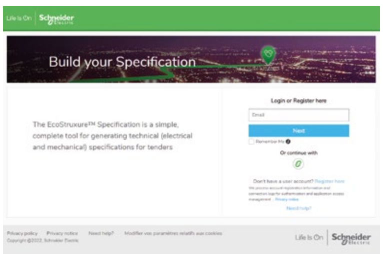
The objective of this document is to offer support and guidelines to fulfill the needs of customers in charge of eMobility infrastructures deployed in building and fleet applications.

This document details the system design considerations for the electrical installation that must be taken into account when designing an eMobility infrastructure with electrical distribution and digital architecture.

It also helps to select the most appropriate architecture according to the building owners and charge point operators' needs, and provides guidelines on implementation to meet the system design considerations.

This technical guide provides a special focus on all the necessary building blocks required at each level, for each application.

**Build your specifications**




To evaluate the systems, connect to Schneider Electric on-line specification tool.


Schneider Electric
DC Meter A
DC Meter B
CCS2 A
CCS2 B
EVlink

# Table of Contents


C

# INTRODUCTION

# EcoStruxure for eMobility

## Introduction

Part of EcoStruxure™, our IoT-enabled architecture end-to-end platform, EcoStruxure™ for eMobility is a holistic solution, beyond the charging infrastructure, where the whole electric mobility ecosystem is connected to provide an optimized and cleaner energy management strategy for multifamily homes, commercial and industrial buildings and fleets of vehicles.

This involves building the mobility of the future.

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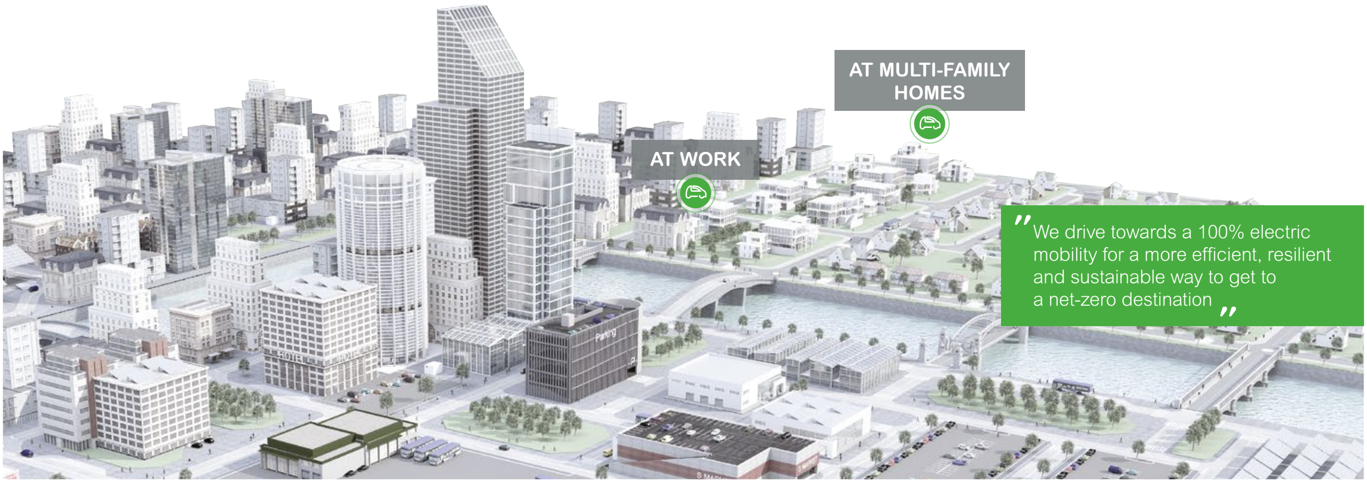


## EcoStruxure for eMobility | Schneider Electric

| | |
|---|---|
| Open architecture for customer flexibility | Vendor agnostic solution that connects EV chargers, power distribution and software to enable services. |
| EcoStruxure ready | Open to EcoStruxure digital architectures. |
| Building upgrade solutions | Deep expertise in electrical distribution enables end-to-end customer solutions, managing electrical upgrades easily |

# EcoStruxure for eMobility




Charging Station Management System (CSMS)

**APPS, ANALYTICS AND SERVICES**

## EcoStruxure™ EV Advisor

Cloud-based supervision for installers, fleet operators, and charge point operators, to easily commission, monitor, and control the EV charging infrastructure.

**Schneider Electric for eMobility solution is open to third party***

Supervision

**EDGE CONTROL**

## EcoStruxure™ EV Charging Expert

A charging load management system that helps efficiently control EV infrastructure and smartly distribute available power to the charging stations.

Load management system

**CONNECTED PRODUCT**

EV Supply Equipment (EVSE)

## EVlink Charging Stations

EVlink Pro AC Metal

EVlink Pro AC

EVlink Smart Wallbox

EVlink Pro DC 120-180 kW

Equipment

*to be confirmed with third party vendors

**Electrical distribution for eMobility**

From grid to EV


PrismaSeT Switchboard | Canalis EVlink terminal distriution kit | iMnx Undervoltage release tripping unit | iEM Energy Meters | Acti9 A-Si type | Acti9 B type | ComPacT NSX | VigiPact add-on

# General Methodology

## Designing eMobility Infrastructure for residential and commercial buildings

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An electrical installation for charging station infrastructure is much easier to define if you consider 4 main inputs before designing the architecture:

### Understanding EV drivers charging usages

SECTION 1

- > EV drivers' profiles and needs
- > Charging capacity and parking configuration
- > Customer case illustration

### Defining electrical distribution, and installation characteristics

SECTION 2

- > Main criteria that can influence design
- > Electrical Infrastructure integration
- > Installing Electrical Vehicle Supply Equipment (EVSE)
- > Customer case illustration

### Setting the appropriate power management strategy

SECTION 3

- > Load Management System overview
- > Dynamic versus Static loads management
- > Smart charging and local energy generation
- > Customer case illustration

### Considering the operational requirements

SECTION 4

- > Communication network definition
- > Cybersecurity landscaoe and rules for eMobility
- > Cloud-based Supervision Systems
- > Payment of the charging session
- > Supervision through Facility Management Systems
- > Services along the infrastrucure lifecycle
- > Customer case illustration

### Reference Architectures

SECTION 5

# SECTION 1

## Understanding EV drivers charging usages



## Who has charging needs?

- ☐ Dwelling owners or tenants in residential buildings
- ☐ Employees or/and visitors at tertiary buildings
- ☐ Customers, subscribers

## What are EV drivers charging needs?

- ☐ Number of EV drivers, number of charging sessions
- ☐ Average charging time and average number of sessions
- ☐ Extra range expected per charging session

## What is the parking configuration and where are the charge points going to be installed?

- ☐ Number of parking zones
- ☐ Number of parking spaces
- ☐ Outdoor and/or underground
- ☐ Individual and/or shared parking


## How many chargers are going to be installed?

- ☐ Less than 10
- ☐ From 10 to 100
- ☐ More than 100

## What is the expected capacity per charge point?

- ☐ AC from 3.7 to 22 kW
- ☐ DC 60 kW
- ☐ DC from 120 to 180 kW

## Is there any plan to extend the EV charging infrastructure in the future?

- ☐ ..........................................................................................................

# Understanding EV drivers charging usages

## 1 EV drivers' profiles and needs

**How long will the EV drivers stay?**
**What distance has been traveled before reaching the stopping area or what distance will be traveled afterwards?**
**When did they arrive?**
**When will they leave?**

Each EV driver has got their own mobility profile and at this stage it's only possible to define or estimate the typical usage based on the place where they will charge.

The turnover of vehicles can be different considering the targeted usage of each charger.

As an example, for residential markets, the vehicles will mainly be charged overnight, while fast charging will be requested for supermarkets and top-up loads. And very fast charging will be required to recover a full carload on highways.

Authentication modes, tariff rules, and reservation methods are also significant levers influencing the EV driver behavior and the level of frequentation.

### Correspondence between charging station location and Electrical Vehicle Supply Equipment (EVSE) power:

**Total power output of the charging system**

| Requirements for charging site: quantity of charging points and durations | | | | |
|---|---|---|---|---|
| **Site typology** | Residential buildings | Work places | Shopping malls | Stores |
| **Charge time** | 8-12 h | 8 h | 1-2 h | 30-60 min |
| **Extra range** | 50-300 km | 50-150 km | 20-100 km | 20-60 km |

**Average charging time** of a typical electric passenger car for a 40 km trip

| 22 kW charging station | 7 kW charging station | Domestic socket |
|---|---|---|
| 20 min | 1 h | +4 h |

> Learn more

Wiki guide for Electrical Vehicle charging

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### Focus on technology

**As an example,** with Mode 2, the charging capacity is limited to 2.3 kW, while Mode 3 provides faster and more efficient 7.4 kW capacity for battery charging.

**The effective charging capacity is defined by the weakest link.**

| Vehicle charger | Cable/charging mode | Charging point | Effective charging capacity |
|---|---|---|---|
| 7 kW | 2.3 kW (Mode 2) | Domestic power socket<br>2.3 kW (Mode 2) | 2.3 kW |
| 7 kW | 7.4 kW (Mode 3) | Charging station<br>22 kW | 7.4 kW |

# Understanding EV drivers charging usages



## 2/ Charging capacity and parking configuration

**How many and what type of charging points should I install?**
**What minimum power would be necessary?**

Today there is no real standard rule to define or to give a straightforward answer to these questions but there are more and more local regulations that accompany eMobility market growth and fast-growing sales of BEV and PHEV vehicles.

**The first stage will be to check the local regulations and guidelines.**

### Without considering any local rules, here are some guidelines and recommendations for estimations.

Number of EVSE to be pre-set in any installation

$$N * A = \frac{P_{ev}}{P_{evse} * C\,fn}$$

N: total number of parking spaces at the location
A: percentage of parking spaces to be equipped with EVSE
$P_{ev}$: minimum power to be reserved for EV infrastructure at the location

Minimum power reservation for EVSE infrastructure design

$$P_{ev} = A * N * P_{evse} * C\,fn$$

$P_{evse}$: power of EVSE to consider as a reference for the location
C fn: demand factor

## Defining charging station specifications*

| Charging capacity per charging point | | | | | | |
|---|---|---|---|---|---|---|
| Power | 3.7 kW | 7.4 kW | 11 kW | 22 kW | 60 kW | 180 kW |
| Extra range / h | 19 km | 37 km | 55 km | 110 km | 300 km | 900 km |

Charged range per hour calculated as 20 kWh / 100 km

**Average charging time** to charge 50 kWh (250 km) batteries to full

| Power | Charging time | |
|---|---|---|
| 180 kW | < 30 min | EVlink charging station |
| 60 kW | < 1h30 min | |
| 22 kW | < 3 h | |
| 11 kW | < 6 h | |
| 7.4 kW | < 8 h | |
| 3.7 kW | < 15 h | |
| 2.3 kW | < 27 h | Domestic socket |

### Focus on technology

The power of the source determines the charging speed**

**Example:** for a vehicle with a 40 kWh battery:

| Source used | Domestic power socket | Dedicated AC power socket | | Dedicated DC power socket | |
|---|---|---|---|---|---|
| Power | Single-phase: 2.3 kW | Single-phase: 7.4 kW | Three-phase: 22 kW | 60 kW | 180 kW |
| Time for a full charge | 18 h | 7 h | 2h30 min | 60 min | 20 min |
| % of charge reached in 30 min | 3% | 7% | 20% | 33% | 100% |

(**) Subject to the use of a suitable cable.

### Learn more

**Wiki guide for Electrical Vehicle charging**

*For DC chargers, charging time depends on the charging profile of the vehicle

# Understanding EV drivers charging usages

## Defining minimum power reservation for AC chargers

### Number of places to pre-equipped, based on the parking configuration

| Parking places | N < 40 | | | | N > 40 | | | |
|---|---|---|---|---|---|---|---|---|
| | A | $P_{evse}$ | C fn | Minimum Power reservation | A | $P_{evse}$ | C fn | Minimum Power reservation |
| **Residential buildings** | 50 % | 7.4 | 0.4 | 20 % | 75 % | 7.4 | 0.4 | 20 % |
| **At work:** offices or industrial buildings | 10 % | 11 | 0.4 | 10 % | 20 % | 11 | 0.4 | 20 % |
| **Public parking** | 10 % | 22 | 0.4 | 10 % | 20 % | 22 | 0.4 | 20 % |
| **At destination** | 5 % | 11 | 0.4 | 5 % | 10 % | 11 | 0.4 | 10 % |

With :
**N:** total number of parking spaces at the location
**A:** percentage of parking places to be equipped with EVSE
**$P_{ev}$:** minimum power to be reserved for EV infrastructure at the location
**$P_{evse}$:** power of EVSE to consider as a reference for the location
**C fn:** demand factor

C fn should be adapted to car park usage and expected charging station availability.
C fn = 1 if you expect all your charging stations to be used at full power at the same time.

# Understanding EV drivers charging usages

Charge Point Operator

Building owner

## An office building with multiple areas and type of usages

CUSTOMER CASE
illustration #1

CUSTOMER CASE
illustration #2

CUSTOMER CASE
illustration #3

CUSTOMER CASE
illustration #4

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The following usages have been defined:

Employees

**Service vehicles / fleet vehicles:**

Vehicles charged over the night.
- 7.4 kW AC chargers x10

**Private employee vehicles:**

Vehicles charged during the day.
- 22 kW AC chargers x10 can cover the need

Visitor / Customer

**Customer and visitor vehicles:**

Vehicles charged during short stays.
- One 180 kW charger is appropriate for this use case
- 22kW AC chargers x4

| Application | EV Charger Power | | | Demand factor (Cfn) | Charging period | kW max | kW min | Total kW |
|---|---|---|---|---|---|---|---|---|
| | 180 kW | 22 kW | 7.4 kW | | | Day | Night | |
| Service / fleet vehicles | | | 10 | 0.8 | night | 0 | 59.2 | 59.2 |
| Private employee vehicles | | 10 | | 0.5 | day | 110 | 0 | 110 |
| Visitor/ Customer | 1 | 4 | | 0.5 | day | 214.4 | 0 | 214.4 |
| Total | | | | | | 324.4 | 59.2 | 383.6 |

In this example, the power has been calculated with some demand factor (Cfn) below 1, assuming that a Load Management System such as EVlink Charging Expert is regulating the EVSE power demand.

Without a load management system, the demand factor would have been 1, as defined in IEC 60364-7-722 "Requirements for special installations or locations – Supplies for Electric Vehicles".

SECTION 2

# SECTION 2

# Defining electrical distribution and installation characteristics


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## What is the power capacity dedicated to the charging infrastructure?

- ☐ ……………………………………………………………………………………………
- ☐ ……………………………………………………………………………………………

## How is the charging infrastructure going to be supplied?

- ☐ Individual utility meter for each parking spaces (residential buildings)
- ☐ Dedicated supply for the EV charging infrastructure
- ☐ Supplied from the building
- ☐ Single phase / Three phases

## Are there any existing chargers to be considered - Schneider Electric or other manufacturers?

## Where are the chargers going to be installed?

- ☐ Outdoor / underground
- ☐ Wall mounted / floor mounted

## How is the electrical / power distribution going to be managed?

- ☐ Centralized (switchboard) versus distributed (CANALIS)
- ☐ New switchboard to be created versus existing switchboard upgrade
- ☐ Protection / metering in the charger versus protection in the switchboard / tap-off unit

## Are there any power meters already installed?

- ☐ ……………………………………………………………………………………………
- ☐ ……………………………………………………………………………………………

# Power requirements and installation characteristics

## 1 Main criteria influencing design

**What is the required electrical protection?**
**How is the charging infrastructure going to be supplied?**
**Does it impact my Infrastructure's electrical distribution?**

### Electrical Vehicle standards

Charging an electric vehicle means connection to a powerful electricity supply.
All electrical installations should be properly designed, constructed, and treated according to the IEC standards for EV installations.

The user or integrator should always perform an appropriate complete risk analysis, and test the system with respect to the relevant specific application or use thereof.
Learn more:

The International Electrotechnical Committee (IEC) has defined a set of standards, covering devices, protection and electrical installation.

### IEC 61851 standard for EV supply equipment (EVSE)

This standard defines the fundamental aspects of EV charging and contains all the requirements covering the EVSE, as equipment. Therefore, the EVSE must comply with the IEC 61851 series and shall be supplied according to IEC 60364-7-722 Requirements.

Electric Vehicle Supply Equipment complying with IEC 61851-1 edition 3

### IEC 60364 - part 7-722 for Low Voltage installations

The international series of standards for Low Voltage Electrical Installations (IEC 60364 series) contains a new part dedicated to supplies for electric vehicle.

IEC 60364 part 7-722 requires electrical protective measures:
- **Protection against short-circuits and overloads with circuit breakers**
- **Protection against electric shocks and risks of electrocution with a 30 mA RCD.**
- **Protection against overvoltage with a surge protection device (SPD).**

Acti9 iC60 circuit breaker

Acti9 B type
Earth leakage protection

Acti9 Surge Protection Device

### IEC 60947-2 - annex B, IEC 60755 and VDE 664

Protections are already integrated in fast DC charging stations but an additional earth leakage protection may be required to comply with specific local regulations, in case of long wiring or operation down to -25 °C.

ComPact NSX

VigiPact

# Power requirements and installation characteristics

## IEC 61969-3 standard for enclosure installed outdoor

- IEC 61969-3 for outdoor enclosure (climatic, biological and chemical tests)
- IEC 60297-3-100 installation of electronic equipment
- IEC 62208 and UL50 Empty enclosures
- ISO12944 C4H Anti-corrosion

Class II Electrical protection (for Polyester enclosures) People safety

PanelSeT SFN

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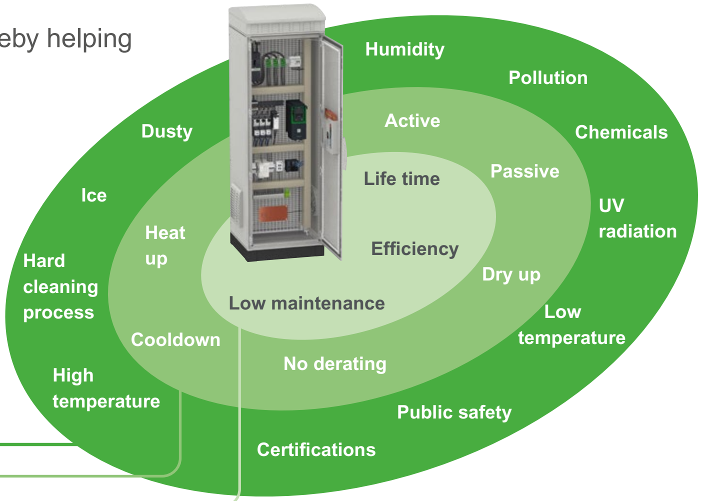
## Electrical Vehicle standards

Selecting the correct enclosure and thermal management is crucial in helping guarantee the target performance.
This also safeguards the equipment installed inside thereby helping ensure continuity of service.




### Correctly selecting an enclosure and thermal solution

Many influences must be considered when defining an enclosure system. They may be split into three groups:

- Protection (Equipment and people)
- Thermal management
- Solution profitability

### Protection

Enclosures help protect the equipment installed inside against the external environment, and help protect people against accidental contact with the electrical equipment it contains.

**Protection against the environment**

This concept includes the following:

Rain / Snow / Ice / Humidity / Pollution / Chemicals / UV Radiation / Low temperatures / High temperatures / Cleaning process / Dust / Salt / Sand storms / Wind / Chemicals / Fauna / Flora / Vandalism / Burglary / …

**Helping protect people from electrical accidents**

This concept includes the following:

Public areas / Non segregated private areas / Segregated private areas / Vandalism / Burglary

### Thermal management

Thermal management system must help guarantee control of the temperature and humidity inside the enclosure.

The correct solution must be based on a robust process starting with the environment diagnostic, then calculating the parameters and defining the best architecture (Enclosures + Equipment installed + Thermal solution).

ClimaSys is the hardware solution following an audit performed with dataloggers and ProClima thermal calculation software.

# Power requirements and installation characteristics

## The environment and the enclosure

The table below is only indicative and not binding. It shows, in a general concept, the optimized performance of the universal enclosures ranges according to the environmental conditions, taking into account technical and commercial criteria:

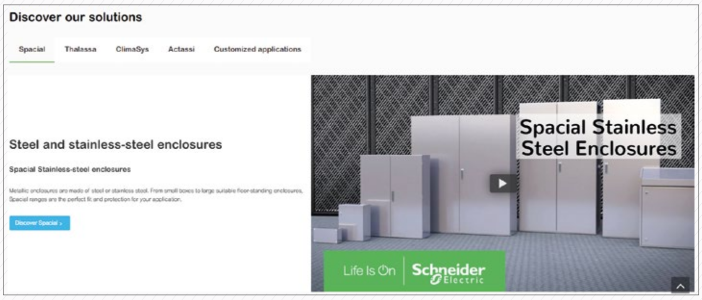
■■■ Highly recommended
■ Recommended
- Not recommended

| Environment | Enclosure material | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Steel** | **Steel Heavy Duty** | **304L stainless steel** | **316L stainless steel** | **Stainless steel Paint** | **Polyester** | **Polyester Heavy Duty** |
| Indoor clean environment (1) | ■■■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Outdoor (no public access) | - | ■■■ | ■ | ■ | ■ | ■■■ | ■■■ |
| Outdoor (public access) | - | ■ | ■ | ■ | ■ | ■ | ■■■ |
| Harsh chemicals | - | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| Solar radiation | - | ■■■ | - | ■ (3) | ■ (3) | ■■■ | ■■■ |
| Sand storm | - | - | ■■■ | ■■■ | - | ■ | ■ |
| Temperature > 40ºC (2) | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| Temperature < 5ºC (2) | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| Salty environment | - | - | - | ■■■ | ■■■ | ■■■ | ■■■ |
| Sea water splashes | - | - | - | ■■■ | ■■■ | ■■■ | ■■■ |
| Humidity > 70% (2) | - | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| Impact | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| Heavy pollution | • | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| Vibration (Marine application) | ■■■ | - | ■■■ | ■■■ | ■■■ | ■■■ | - |
| Seismic | ■■■ | - | - | - | - | - | - |
| Electro Magnetic Interference | ■■■ | - | - | - | - | - | - |

(1) Not considering F&B process
(2) Always using ClimaSys solutions
(3) Marine solar plants

## Focus on technology

From small boxes to large floor-standing cabinets, Spacial and Thalassa electrical enclosures suit all applications in industry or infrastructures. In addition, ClimaSys thermal protections keep inside temperature and humidity under control to maximize lifespan of all embedded electrical and electronic components.




> Learn more

**Universal Enclosure General Catalog**

# Power requirements and installation characteristics



## EV Supply Equipment electrical protection and metering

The EV READY Mark is a certification mark that provides an answer to the questions of **Interoperability, Security and Performance for Electrical and Hybrid Rechargeable Vehicle (EV) Charging Stations**.

Launched on the initiative of automobile manufacturers Renault-Nissan, the EV READY mark is the result of technical quality work undertaken at numerous workshops with representatives of all the players in this industry (vehicle manufacturers, AC charging station manufacturers, installers, operators, utilities, networks, standardization organizations, third party laboratories, etc.).

The EV READY mark results in a Third-Party Certification process that takes into account both the product and its installation. In this context, ASEFA is the certification body for this mark and delivers the following certificates:

- ASEFA Certificate type 5 for Products
- ASEFA Qualification Certificate for Installers
- EV READY Certificate for Installed Products

### Learn more


Wiki Guide
**for electric vehicle charging**


White Paper
**Safety measures for electric vehicle charging**


Technical reference document
**"E.V. READY" Certification**

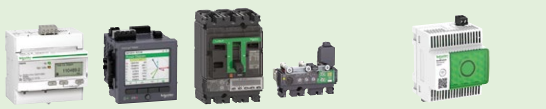

Guide
**Earth Fault Protection**

Focus on technology

### Schneider Electric Power distribution

**Electrical Protections**


**Energy Efficiency**




**Scalability**


Metering solutions display the active energy consumed to:

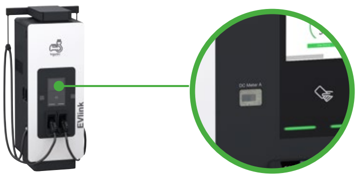
- Maximize the power allocated to the EV infrastructure in residential, commercial and industrial buildings.
- Provide a MID certified meter so that payment and billing is linked to the amount of energy consumed.
- Send active energy consumed information in OCPP to a supervision system with communicating meters.

# Power requirements and installation characteristics

## Designing electrical distribution

### DC Charging

For fast and ultra-fast DC charging stations the **additional electrical protections must be installed in the switchboard.**

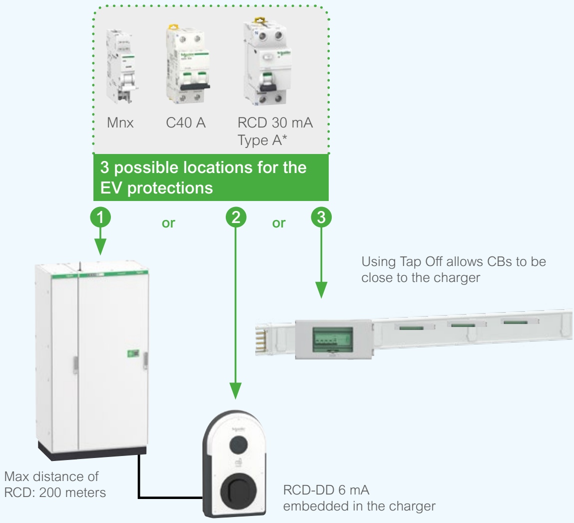


The MID meters are inside the charger.

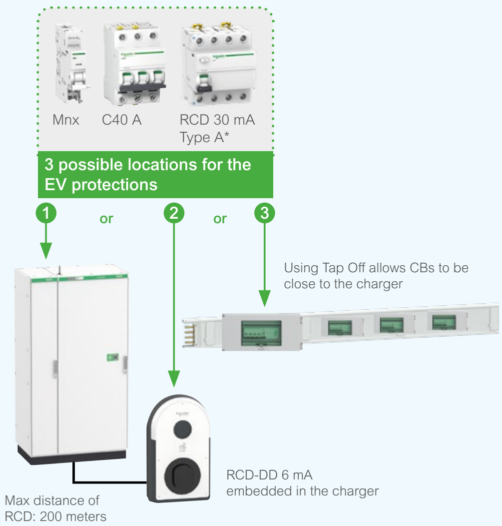
SEE REFERENCE
Architecture for Fleet Depot

### AC Charging infrastructure for indoor parking

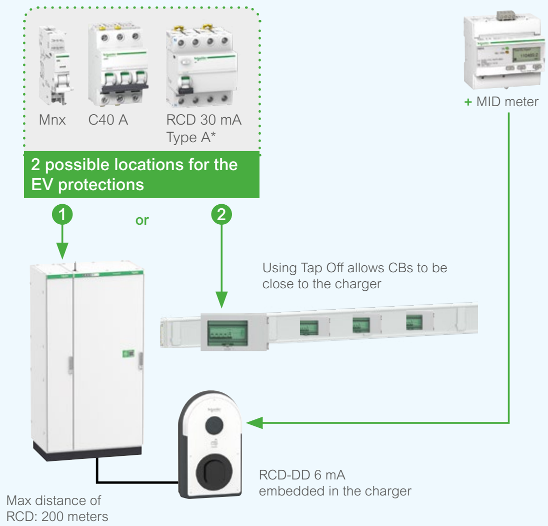
#### Single phase without MID meter




#### Three phase without MID meter




#### Three phase with MID meter




*In countries where the installation standard IEC/HD 60364-7-722 or equivalent local regulations are applied, a RCD type B must be used instead of RCD type A-Si.

**Note:** infrastructure set-up is always related to needs and must comply with local regulations.

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# Power requirements and installation characteristics

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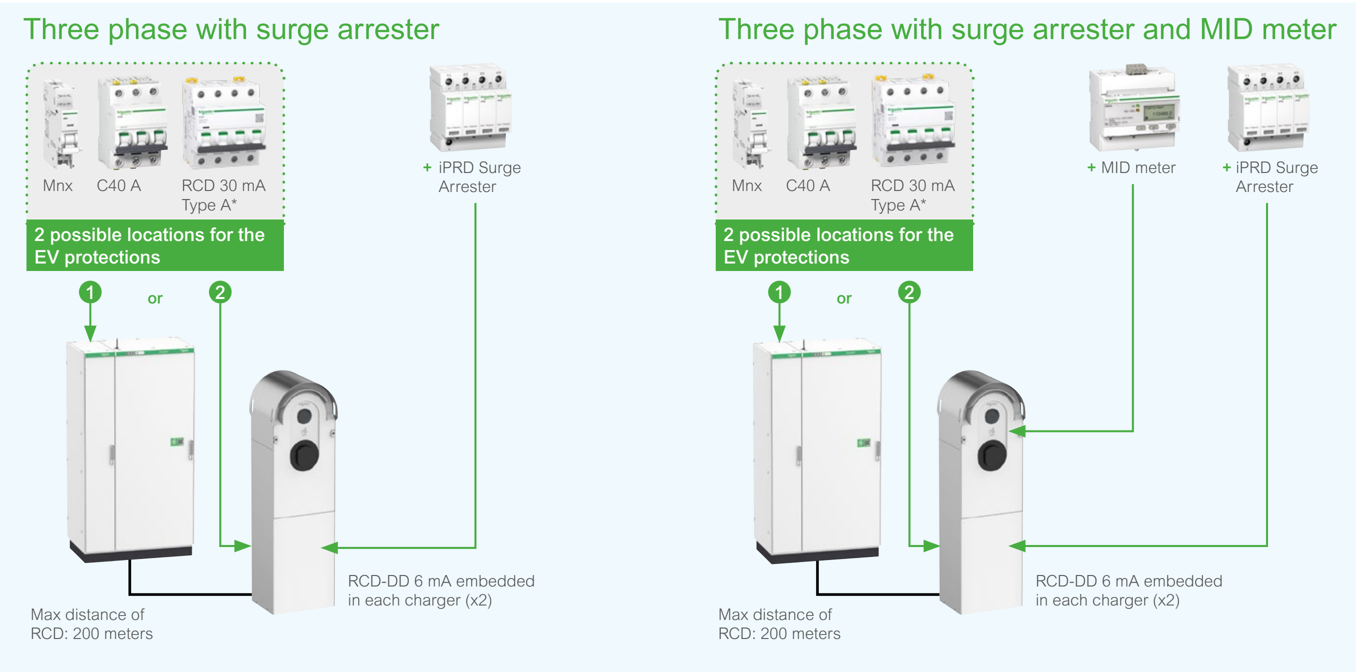
## AC Charging infrastructure for outdoor parking




*In countries where the installation standard IEC/HD 60364-7-722 or equivalent local regulations are applied, a RCD type B must be used instead of RCD type A-Si.

## System Earthings

The 3 system earthings such as defined in IEC 60364 are:

- Exposed-conductive parts connected to neutral - TN
- Earthed neutral - TT
- Unearthed (or impedance-earthed) neutral - IT

It ensures protection of persons and continuity of service, conductors and live parts of electrical installations are "insulated" from the frames connected to the earth.

Note that For EVlink Pro AC the IT mode can not be used with 400 V between two phases

### For detail, refer to:


Cahier Technique n°172

# Power requirements and installation characteristics

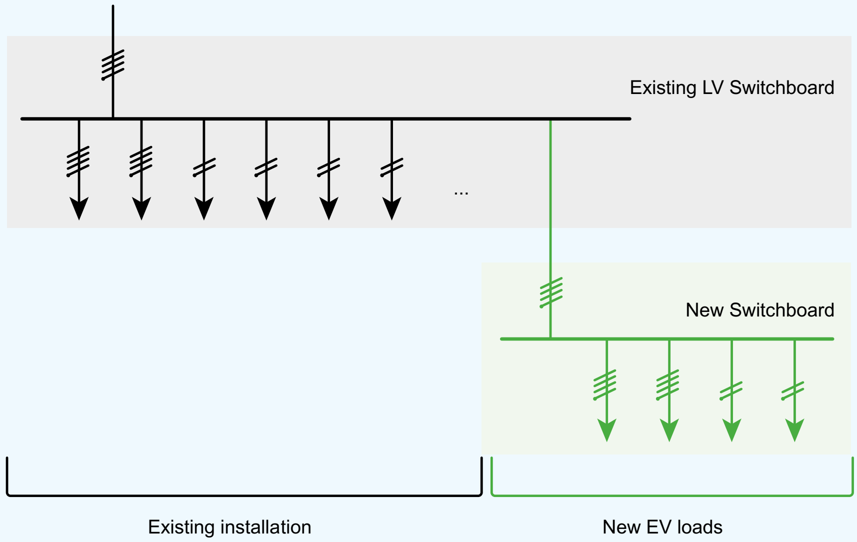
## 2 Electrical Infrastructure integration

The integration of EV charging supply equipment requires an integration of several high-power loads and an adaptation to the existing electrical infrastructure.

This section presents basic principles for designing the EV charging infrastructure and its integration into the existing electrical installation.

### EV charging power demand lower than the installed power demand

If the amount of charging points and their capacity is significantly lower than the installed power, an option to investigate could be to integrate the EV chargers into the existing electrical installation.




EV loads integrated into the existing electrical infrastructure

A preliminary audit is required to assess the capacity of the existing installation to absorb the power demand of the new loads. It should be checked that:

- the utility can provide the new power demand.
- the existing busbar is adequately sized to absorb the new power demand.
- the existing LV panel is adequately sized to absorb the new power demand, and to integrate the additional protection equipment for the EV circuits.
- overcurrent protection selectivity can be achieved between the main circuit breaker and the circuit breakers at the EV circuits.
- selectivity can be achieved for the residual current protections between the main Residual Current Device (RCD) and the RCDs in the EV circuits.
- the RCDs in the existing installation can operate in the presence of DC leakage currents induced by the EV supply equipment.
- overvoltage protection including the new EV charging stations is achieved, with the addition of SPDs if necessary

The integration of EV chargers into the existing electrical infrastructure is an interesting option if it does not require significant changes or replacement of equipment.

# Power requirements and installation characteristics

At this stage of the project, an audit is highly recommended to identify the power load that can be added without changing the existing electrical infrastructure. Energy efficiency measures could be proposed to reduce the existing consumption and therefore increase the power demand that can be added.

Local power supplies and storage could be proposed to compensate for the impact of integrating the EV charging equipment.

If the existing LV switchboard cannot accommodate the additional power and/or devices required, the option described in next paragraph is recommended.

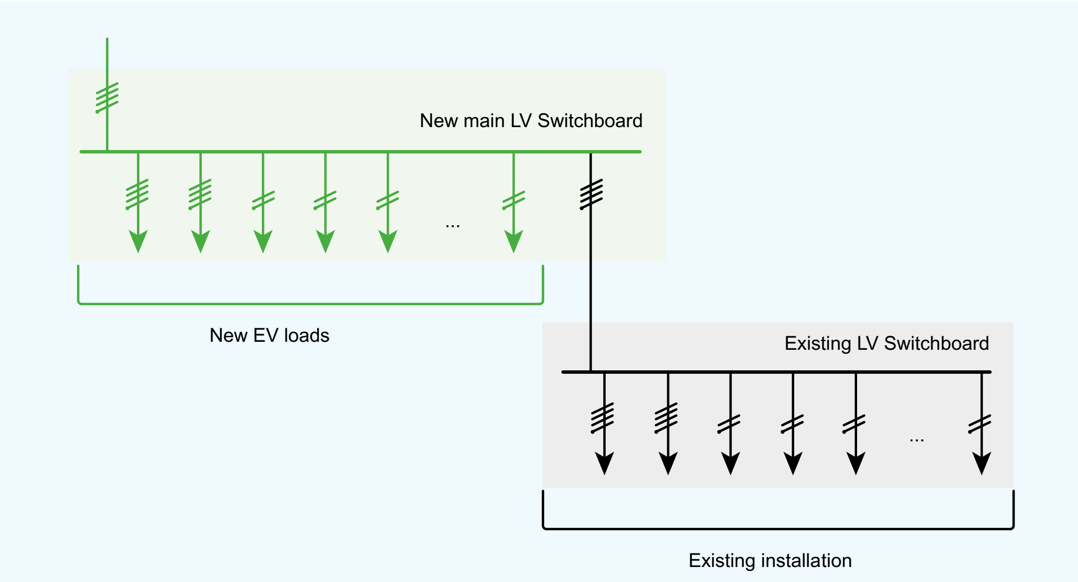
## EV charging power demand equivalent to or higher than the existing power demand

If the power demand of the new EV loads is equivalent to or higher than that of the existing electrical installation, it could be preferable to install a new main LV switchboard to integrate all EV loads.

The existing electrical infrastructure will be connected to this new main LV switchboard. An overcurrent and residual current protection selectivity need to be achieved between the existing installation feeder and the new main incomer.

If there are several EV chargers located in the same area, secondary LV switchboards could be installed close to the EV charging area in order to optimize the cable length.

The creation of a new main LV switchboard presents the advantage of minimizing the changes to the existing electrical installation. In addition, it offers the opportunity to coordinate protection devices, and thus optimize the power availability.




EV loads integrated into a new main low voltage switchboard

# Power requirements and installation characteristics

## Use of local energy supplies to compensate for the EV charging power demand

The integration of EV loads increases the power demand of the electrical installation significantly.

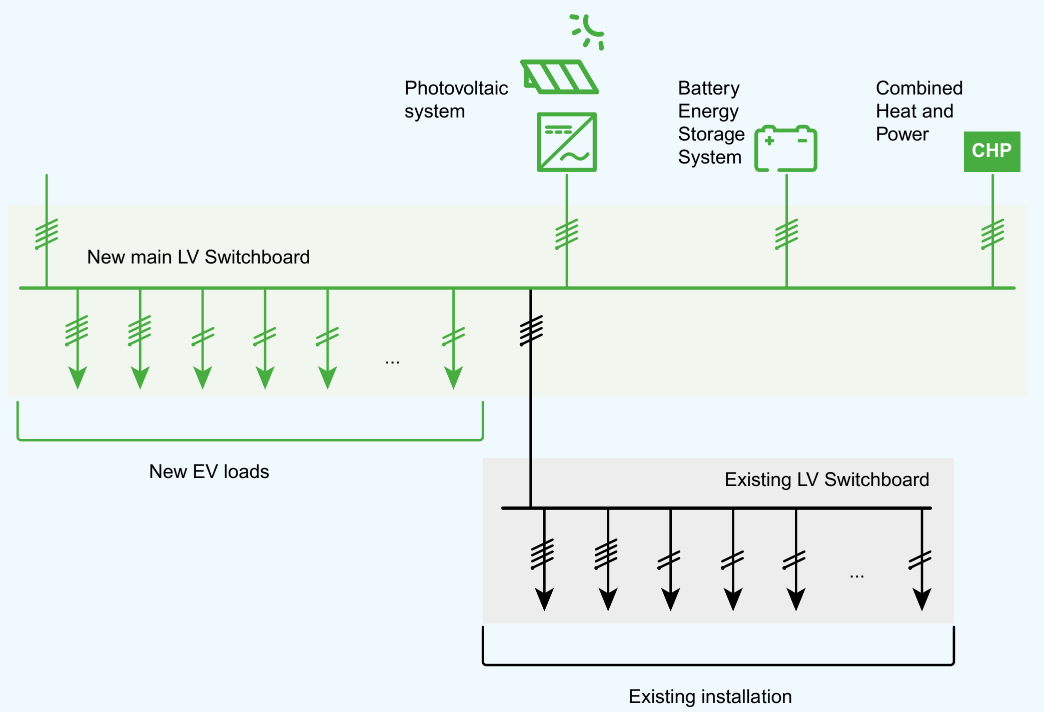
An extension of the local energy infrastructure is often required. A switch from a LV grid connection to a MV grid connection could be necessary in certain cases.

In addition to the electrical infrastructure, the electricity contract with the energy provider needs to be reviewed.

To limit or avoid these types of significant modifications to the existing local installation, local energy power supplies can be added, such as:

- Photovoltaic system: for local energy production and a commitment to sustainability.
- Energy storage system: to avoid power demand peaks and optimize solar production use.
- Combined heat and power (CHP): combined heat and power production if relevant.

Local power supplies can be connected to the new main LV switchboard. Their integration into an existing electrical infrastructure requires a preliminary audit.




EV loads and local power supplies integrated into a new main low voltage switchboard

# Power requirements and installation characteristics

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## 3 Installing Electrical Vehicle Supply Equipment (EVSE)

**Should EVSE be installed on the floor or wall mounted?**
**How can you scale up your needs?**

Floor or wall mounted AC charging stations are easy-to-install, flexible and cost effective solutions for indoor or outdoor areas.

After having followed local design rules or guidelines for power reservation, you can start by installing a reduced amount of EVSE and then to scale it up progressively as per the need.

With centralized distribution, the LV switchboard will handle reservation.

DC and AC Floor standing charging stations

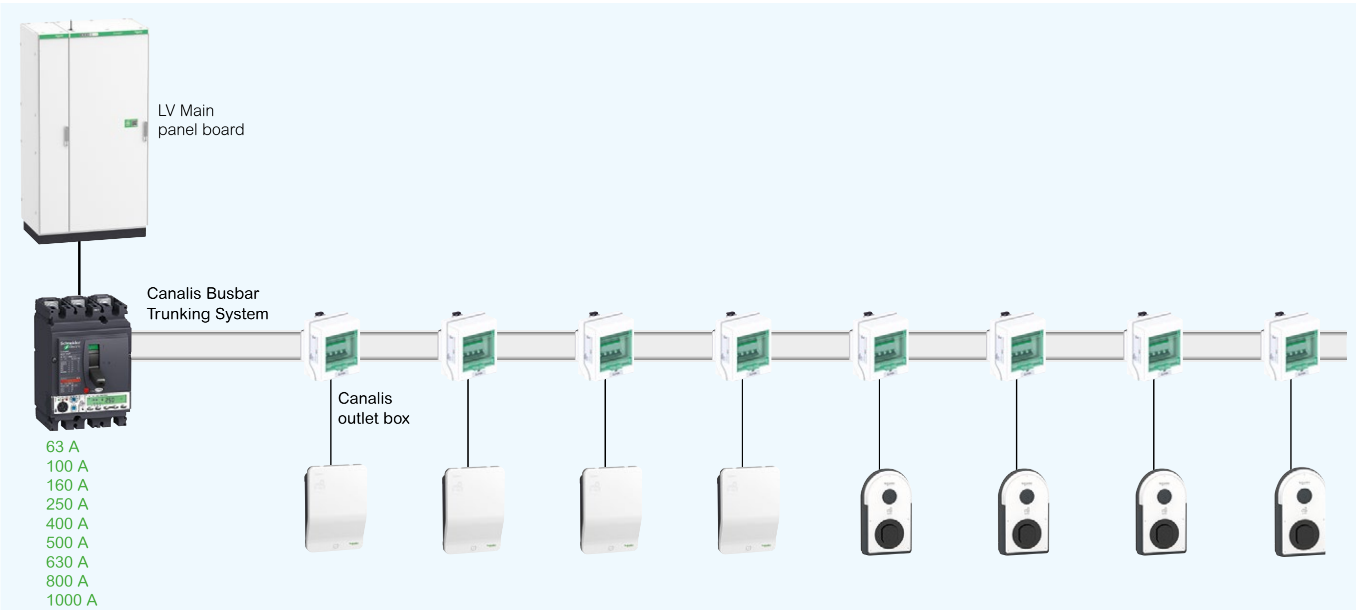
AC wall mounted charging station

# Power requirements and installation characteristics

**How should it be installed?**

To minimize installation costs, and also to facilitate identification of EV charging areas, it is better to group charging points at the same location and then design the appropriate electrical distribution.

The charging station space should be identified with vertical signage (panel) as well as with a floor marking (horizontal signage).




EV infrastructure based on Canalis distribution system

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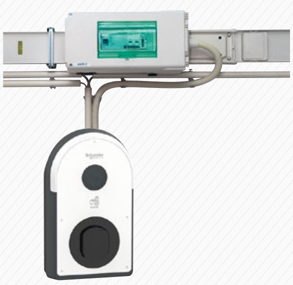
Focus on technology

### EVlink™ terminal distribution kit



Electrical distribution with Canalis™ busbar trunking system allows you to save time and costs during installation, and to be ready for future extensions.

- From 100 A to 1000 A
- Can cover the entire parking area
- Scalable without power switch-off
- Reassemble charging stations without power switch-off
- Easy access to circuit breaker and RCD Type B
- Optimized installation time
- Space saving

# Power requirements and installation characteristics

Charge Point Operator
Building owner

## An office building with multiple areas and type of usage

CUSTOMER CASE
illustration #2

### Power demand calculation:

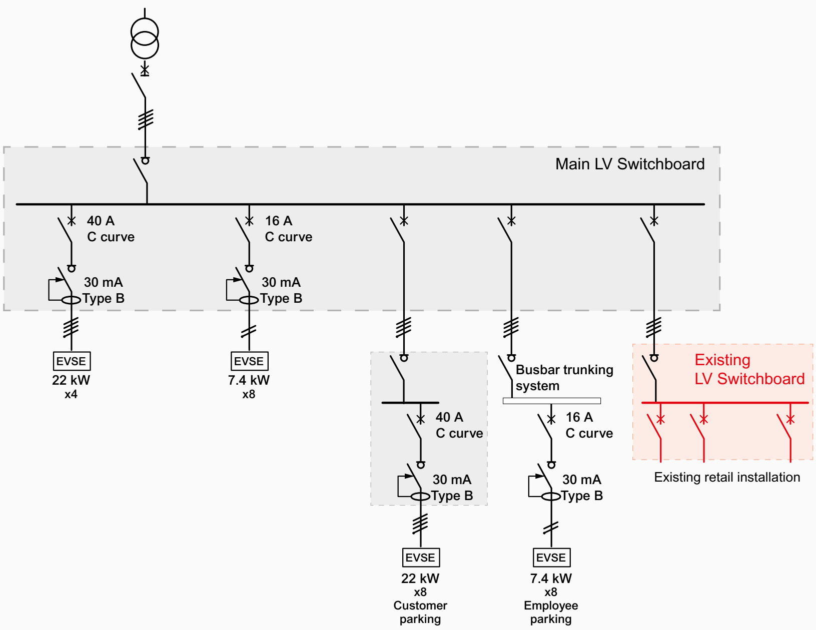
The power demand is calculated for the day-period and the night-period, assuming that the EV charging in the different areas takes place either during the day or during the night.

The maximum (day or night) power demand is used to size the electrical installation busbar, main incomer protection and switchboard, if a Load Management System pilots the EVSE.

Otherwise, the total power demand should be used for the sizing.

In this case, the overall EV power need is ~350 kW and this is higher than the 250 kW power installed in this office building (~2000 m²). Without any additional power generation, the choice is to add a new LV switchboard and to connect EV loads and the current building switchboard to the new LV switchboard (as per the fig. below).

The figure below gives an example of an EV charging infrastructure corresponding to the above assumptions.




All EV loads are connected to a new main Low Voltage Switchboard.

- Each EV circuit is protected by a circuit breaker and 30 mA type B residual current device as required by IEC 60364-7-722.
- As there are several single phase EVSE of 7.4 kW, it is recommended to connect them equally among the 3 phases to avoid unbalance
- As there are several EVSE located in the same area (outdoor customer parking), it could be worth while to install nearby a LV panel in order to optimize the number of cables and cabling length.
- As there are several EVSE located in the same area (indoor employee parking), a busbar trucking system can be used to provide upgradeable and flexible solution.
- As the existing dealership installation is connected to the new main LV Switchboard, overcurrent and residual current protection selectivity need to be considered.
- The additional new EV loads increase the power demand significantly. An MV connection is required.

CUSTOMER CASE illustration #1
CUSTOMER CASE illustration #3
CUSTOMER CASE illustration #4
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SECTION 3

# SECTION 3

# Setting the appropriate power management strategy


What is the power capacity dedicated to the charging infrastructure?

- [ ] ........................................
- [ ] ........................................

Is there any risk that EV charging infrastructure power demand exceeds its power capacity?

- [ ] ........................................
- [ ] ........................................

Is there a need for dynamic optimization of power availability among the EV charging infrastructure and the building?

- [ ] ........................................
- [ ] ........................................

Is there any local energy generation to consider: PV, battery storage…?

- [ ] ........................................
- [ ] ........................................

# EV charging power management strategy

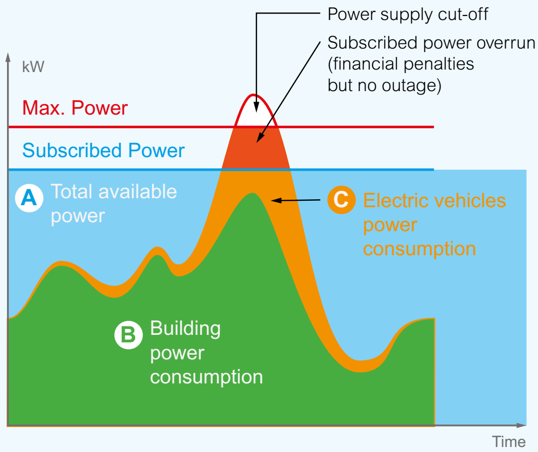
## 1 Load Management System overview

**Why is a Load Management System recommended for controlling EVSE?**

A Load Management System to control EVSE power demand is highly recommended as it optimizes the impact of a charging solution's consumption on an electrical installation.

### The problem

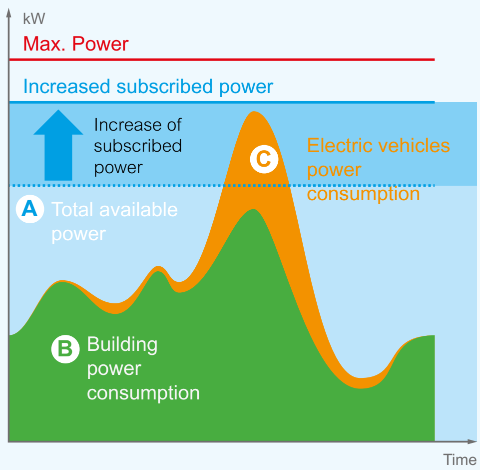
Initial situation




The installation of charging stations in an existing electrical network can have a significant impact due to the power level required by electric vehicles to charge.

### Solution without energy management

Increase of subscribed power




Increasing the power subscribed to the energy supplier increases the cost but the trigger threshold can still be exceeded with potential discontinuity of service for all the activities.

If such a solution is not installed, the installation should be sized for the maximum power demand without considering the charging period and usage coefficient. As a result, the installation will be oversized compared to the real need, and the costs of the EV charging infrastructure will be higher.

In this case, with the existing loads, the new EV chargers and the photovoltaic production, we recommend a dynamic energy allocation via a general DYNAMIC setpoint.

# EV charging power management strategy

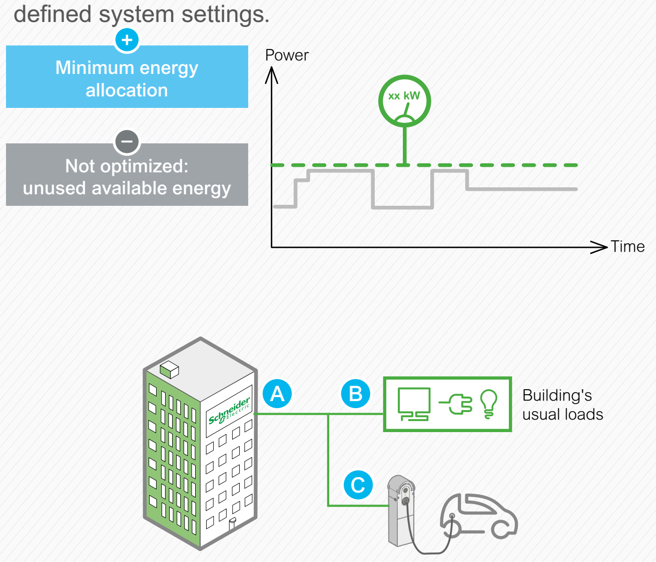
## 2/ Dynamic versus Static loads management

The Load Management System allows EV loads to be monitored, controlled and maximized based on the real-time available power in the building. It helps to ensure the respect of cost and energy efficiency constraints of a set of charging stations by controlling their operation.

The controller runs its management program according to the selected parameters and data received from the charging stations.

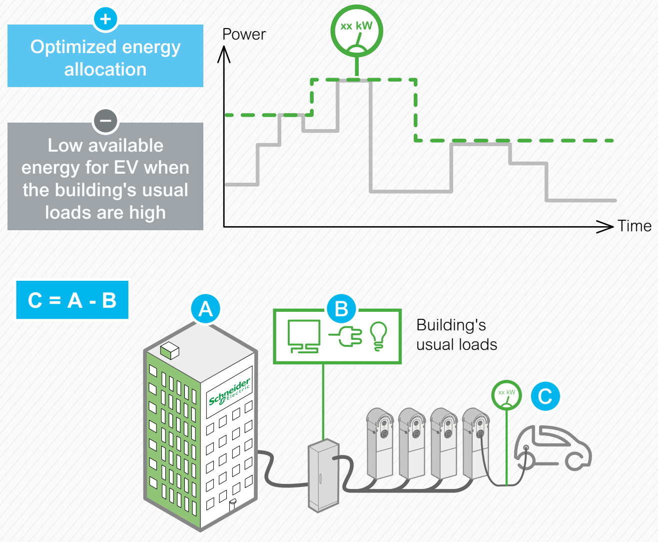
### STATIC loads management

The maximum power value is equal to the subscribed demand or any fixed value. EV Charging Expert dynamically distributes the energy below that fixed value among the chargers based on the energy demand and defined system settings.



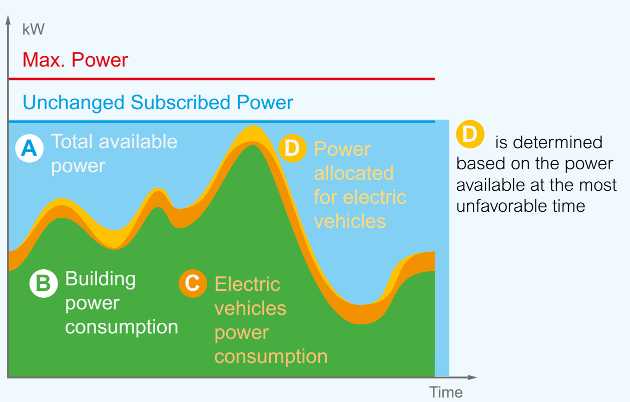

### DYNAMIC loads management

The remaining energy at the building is allocated to the EV infrastructure in real time based on the energy demand and defined system settings.



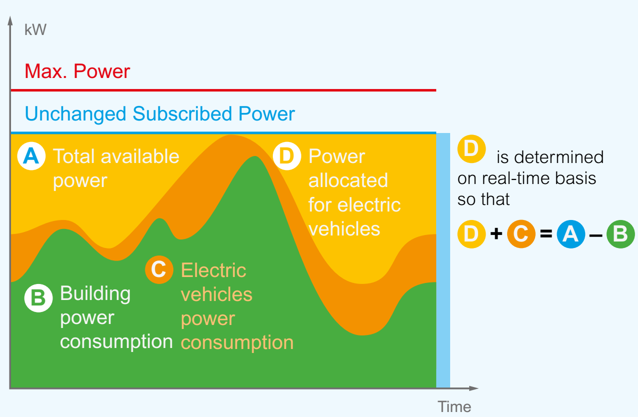

### Determination of the dynamic setpoint

STATIC loads management




D is determined based on the available power at the most unfavorable time and is constant over time.

DYNAMIC loads management




Setpoint "D" is adjusted in real time according to the consumption of the rest of loads in the building, to maximize the power allocated to charging electric vehicles.

# EV charging power management strategy

## Load shedding rules between charging sessions

When the load shedding is triggered (meaning there is not enough power to continue all the charging sessions simultaneously), the algorithm allows the available energy to be distributed according to 2 strategies (depending on the settings):

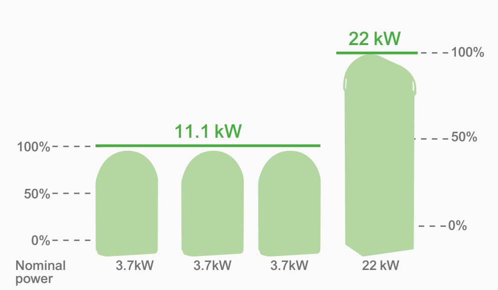
- Based on the energy already consumed: the system interrupts the charging of the vehicles that have obtained the highest amount of kWh since the start of their charging, favoring recently arrived vehicles.
- Based on the connection time: the system interrupts the charging of the vehicles with the longest charging time, favoring those last arrived.

**In both cases, the system rechecks and updates the situation every 15 minutes**

## Descriptive example to illustrate the load reduction and load-shedding operation

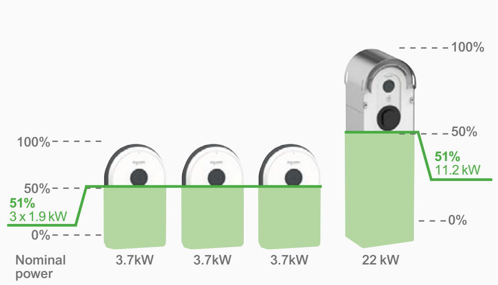
**Available power in the building allocated to EV charging** | **Delivered charging power** | **Description**

**33.1 kW**




The full available energy is delivered.

**17 kW**

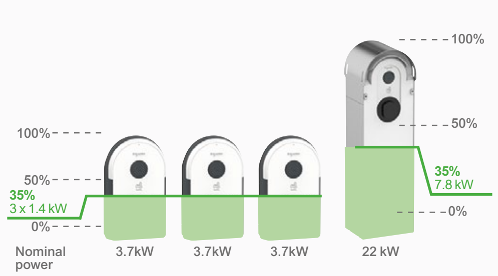



The energy will be delivered according to an equal percentage, in this example: 51%.

**Details**

17 kW / 33.1 kW = 51%.

**12 kW**

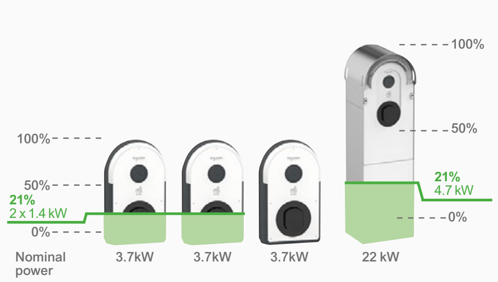



When reaching the minimum current setpoint of a charge point, its current level will be maintained so that the EV keeps charging.

**Details**

Min. current for an EV to charge (according to IEC 61851) = 6 A, representing 1.4 kW of a 3.7 kW charging station.
12 - (3 x 1.4 kW) = 7.8 kW, that are provided by the 22 kW charging station.

**7.5 kW**




If there is not enough power to feed all the charging stations, charge point load shedding will be triggered, following the load shedding rules.

**Details**

With 6 A (1.4 kW) per active charging station (IEC 61851 minimum current), the 7.5 kW of charging power are respected by switching off 1 charging station.
7.5 - (2 x 1.4 kW) = 4.7 kW, that are provided by the 22 kW charging station.

# EV charging power management strategy

## 3 Smart charging and local energy generation

- **What is smart charging?**
- **Why do buildings need smart charging for EVs?**

### Smart charging

Smart charging refers to a system that is able to monitor, manage, and eventually regulate the use of EV charging devices with the aim of optimizing energy consumption.

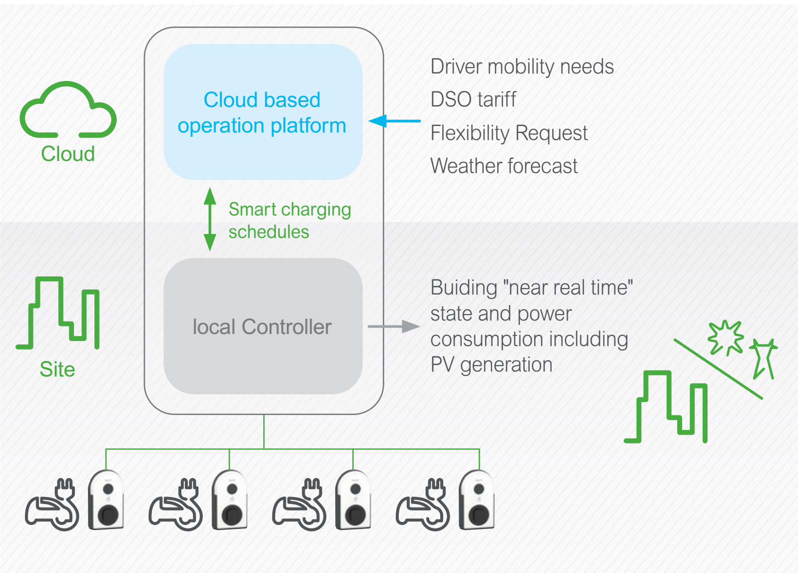
The adjective “smart” underlines how this solution is able to intelligently and flexibly adapt the charging strategy to meet both the needs of EV users and the power grid.

A smart charging system will allow flexibility, optimized energy consumption, infrastructure scalability, and cost efficiency.

### Smart charging for EVs in buildings

A smart charging infrastructure ensures buildings have power availability by minimizing the EV charging infrastructure’s impact on the existing power distribution system. Smart charging and digitization technologies are used to create a better, more efficient charging experience that makes it easier to integrate renewable energy and provide resilient power.

A smart charging system will reliably meet the increasing power demand from EVs in buildings.



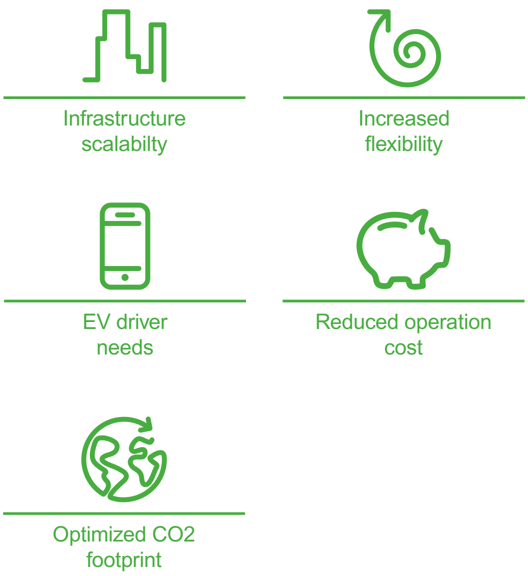

[> Discover an architecture exemple that integrates microgrid values]

**How is smart charging different to traditional load management?**

### Difference between smart charging and traditional load management

The term "smart charging" is frequently used synonymously with the terms "classic load management" and "dynamic load management". However, these are not the same.

Smart Charging goes further than a standard load management setup. It is an intelligent system with proactive logic to schedule and forecast, and therefore provides an optimal charging solution. In a nutshell, each EV plugged into the charging station charges with a specific charging profile. It not only takes into the account the needs of the EV driver (eg. Departure time etc.) but also respects the power limits of the entire installation. On top of this, a smart charging system gives significant OPEX savings to the infrastructure owner by optimizing the locally generated renewable energy (eg. PV installation on the building) and using the dynamic electricity tariffs for cost efficient charging.



# EV charging power management strategy

Charge Point Operator

Building owner

## An office building with multiple areas and type of usage

CUSTOMER CASE
illustration #3

CUSTOMER CASE illustration #1

CUSTOMER CASE illustration #2

CUSTOMER CASE illustration #4

1 2 3 4 5

### Load management system criteria:

- **Total power of the building:** 150 kVA
- **Charging stations power demand:** 350 kVA
- **Total consumption limit:** 250 kVA

Whatever the load of the building and the number of charging stations used at the same time, total consumption should never exceed 250 kVA by asking the chargers to adapt in real time to the building's other loads.

The current setpoint for each of the charging stations will be transmitted in real time to the vehicle which has 5 seconds to apply it.

**Load Management System allocation method allows you to:**

- Distribute the available energy evenly between all the vehicles being charged
- Sequence the loads between the connected vehicles simultaneously
- Control energy costs by subscribing the optimal energy contract from the energy supplier (might not be the case in countries where the energy contract has no limit)

To determine the dynamic setpoint dedicated to the charging infrastructure, the system shall be connected via:

- TCP / IP Modbus to a PM5320 / PM5370 / PM5365 (panel mounted) or PM5563 (DIN rail),
- or Acti9 iEM3x5x with Link 150 gateway,
- or PowerTag with Acti9 SmartLink SI D gateway,
- or MasterPact MTZ breaker and Micrologic control unit with embedded metering,
- or Compact NSX breaker and Micrologic control unit with embedded Schneider Electric metering..

EcoStruxure EV Charging Expert

This stands as a local controller located on the premises with several Charge Points connected, and is acting as proxy OCPP between the Charge Points and CSMS.

Its main role is to deliver an Energy Management system, optimizing the energy delivered to the Charge Points with  the available production capacity, in a cost-effective solution.

Furthermore, it brings resilience of energy management in case of loss of connection in the EV infrastructure or with Cloud based CSMS, avoiding the Charge Points having to be run abruptly in degraded mode (6 A) in case of communication issues.

Lastly, it allows the Charge Points to be operated with CSMS while providing connectivity openness with an on-premises third party system for energy management monitoring and control.

SECTION 4

# SECTION 4

# Considering the operational requirements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## ? What is the communication network architecture?

- ☐ Connectivity to Internet (IT service or 4G)
- ☐ Connectivity with chargers (Star or daisy chain topology)

## ? Are there any cybersecurity risks to consider regarding:

- ☐ The infrastructure
- ☐ The user and data management

## ? How are the eMobility services expected to be managed?

- ☐ Operated internally or delegated to a charge point operator
- ☐ Onsite or cloud -based supervision

## ? What are the eMobility services expected?

- ☐ User access management
- ☐ Cost allocation or charging evidence for free charging
- ☐ Automatic billing and payment / Ad-hoc payment methods
- ☐ Public charging
- ☐ Reimbursement for company cars
- ☐ Troubleshooting and preventive/corrective maintenance

## ? Is there any building operation software that the EV charging infrastructure needs to be integrated with?

- ☐ Microgrid management system
- ☐ Building and energy management system
- ☐ Parking Management System
- ☐ Fleet Management System

## ? If yes…

- ☐ Schneider Electric Building Management System (EcoStruxure Power Monitoring Expert, EcoStruxure Building Operation, EcoStruxure Microgrid Advisor)
- ☐ 3rd party BMS

# EV charging operations

## 1 Communication network definition

This section details the guidelines for the WAN (Wide Area Network: Internet network) and the LAN (Local Area Network for EV chargers based on IPV4 addressing) communication networks. The eMobility digital infrastructure relies on the Ethernet communication network wired for the LAN and wired or wireless for the WAN.

The choice of ethernet communication topology and addressing policy is driven by:
- Customer environment: interconnexion with existing IT infrastructure or isolated EV system
- Existing local edge controller in the EV infrastructure
- Maintainability - scalability of the communication network
- Level of openness of the EV LAN to third party system
- Cloud connectivity WAN and targeted level.

Key recommendations:
- Use Ethernet cables CAT6 as a minimum cable size, and check the cables during the commissioning with the appropriate verification tool
- Check the quality of Ethernet network thanks to manageable switch interface that provides diagnosis features
- Schneider Electric Ethernet switches are recommended. Avoid using Ethernet switches from different vendors
- For EVlink Pro AC charging stations, Ethernet ports parameters are by default set as follow:
  - Speed: automatic detection
  - Duplex mode: automatic detection
  - The recommended settings are: 100Mb/s and full duplex mode.

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### Focus on technology

The Modicon Networking range offers you a smart and flexible way to integrate Ethernet solutions into your operation, from the device level to the control network and to your corporate network.

These managed switches come with the Ethernet TCP/IP protocol.

They come with 4 or 8 copper cable transmission ports.

They provide simple and complex connectivity for multiple Ethernet devices, network management, enhanced cybersecurity and more advanced switching features.

**Unmanaged switch for star topology**

4 ports for copper
MCSESU053FN0

8 ports for copper
MCSESU083FN0

**Managed switch for ring and daisy chain topologies**

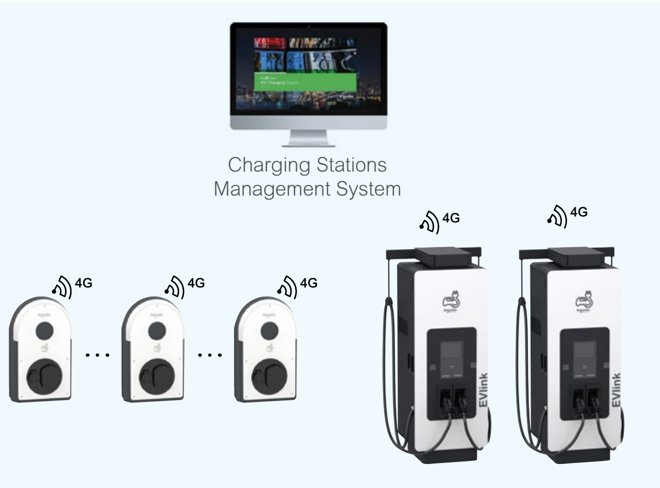
4 ports for copper
MCSESM043F23F0

8 ports for copper
MCSESM083F23F0

# EV charging operations

## Wireless WAN connectivity without local Load management system

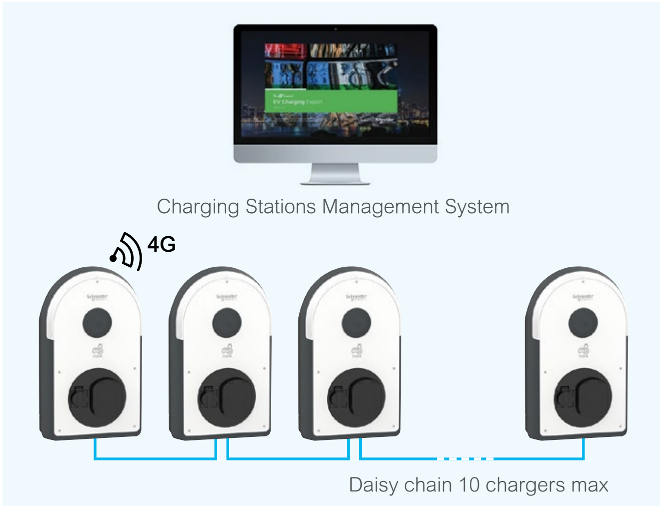
The choice of the wireless communication architecture depends on charging stations number and cost targets. The following illustrations details different possibilities:




**Each charging station can be individually connected to the Charging station Management System***

This architecture provides an independent connection to CSMS for each charger and avoids any Ethernet cabling.

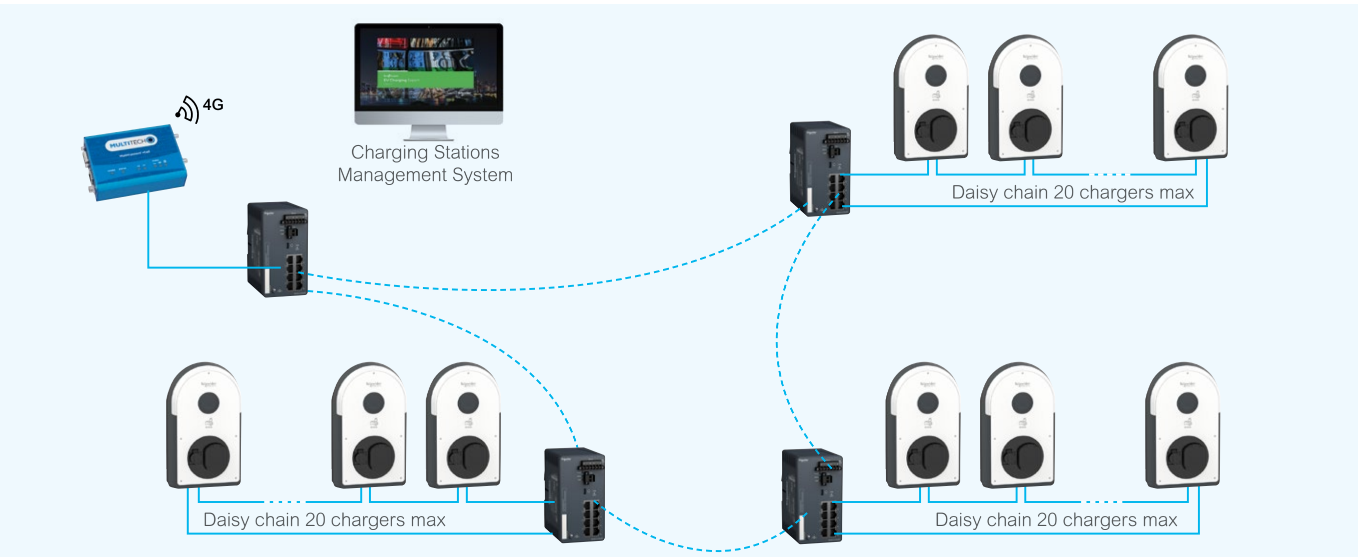
The antenna is embedded in the charger. It cannot be extended outside of the charger so the 4G signal shall only be available where the charger is located.




**4G modem* integrated in one EVlink Pro AC**

The antenna is embedded in the charger. It cannot be extended outside of the charger so the 4G signal shall only be available where the charger is located.

The wired Ethernet connection is represented as a daisy chain, but a star topology can also be used with an unmanaged switch.




**External modem**

This IT design is recommended for a wireless internet 4G connection for more than 10 chargers, or in case 4G connectivity is located outside of the EV infrastructure.

This illustration shows a daisy chain loop on the LAN side, but a star topology can be used too.

*See the next section.*

*Internal 4G modem is an optional accessory for Evlink Pro AC

# EV charging operations

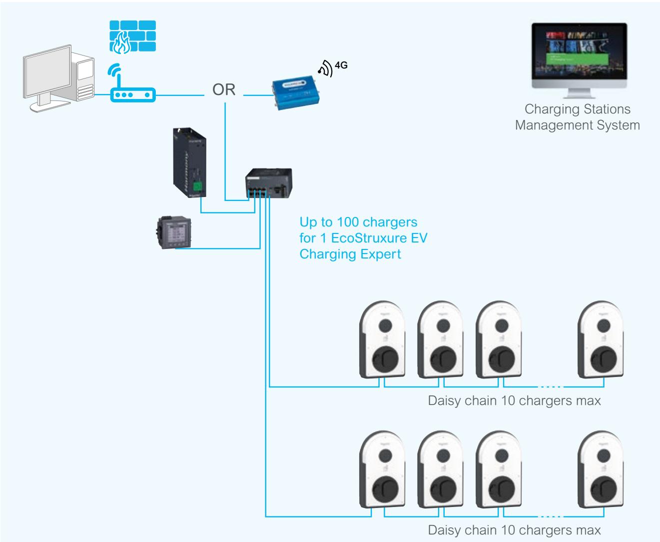
## Communication network with EcoStruxure EV Charging Expert

There are different network topologies: star and daisy chain. To decrease dependency between a group of chargers it is highly recommended to prefer star topology than daisy chain.

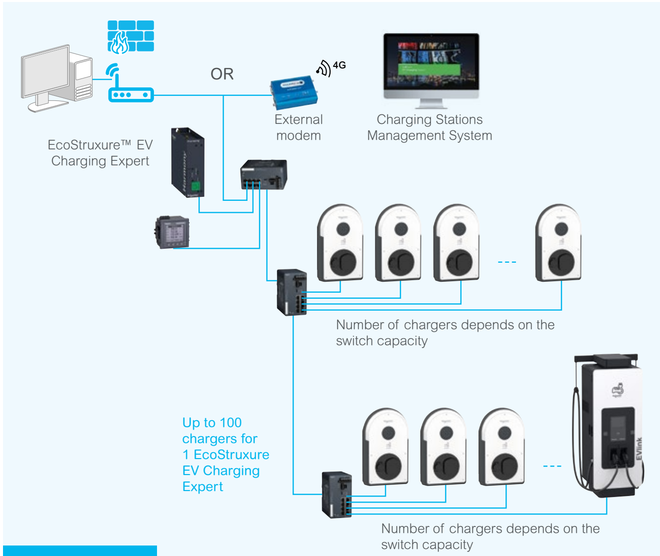
In case of daisy chain topology, it is recommended to build a daisy chain loop topology using manageable switches.

The communication network devices and EcoStruxure EV Charging Expert can be located inside an electrical switchboard (specific area) or in a dedicated IT bay (preferred setup for complex infrastructure).

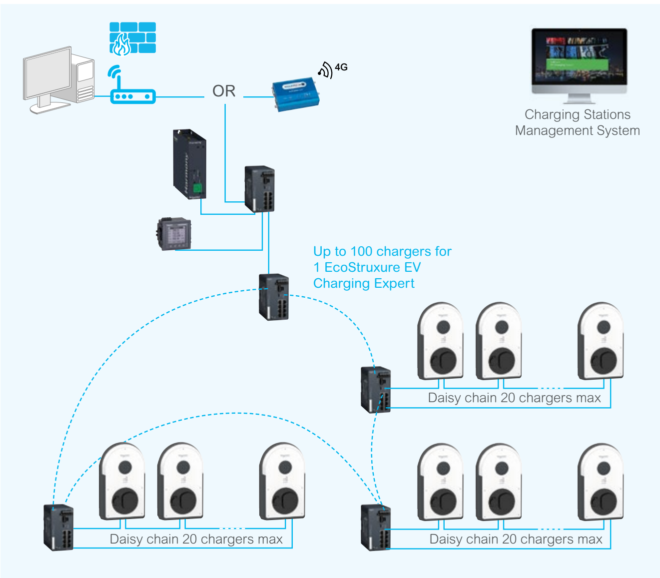
Charging stations' IP adresses and Power meter information are required. EcoStruxure EV Charging Expert can be set in Static mode or in Automatic mode from the dashboard.



Simple Ethernet daisy chain



Star topology



Ethernet daisy chain loop – Ring (*)

**IT information to be consolidated before the Ethernet network installation:**

- **IP addresses**
- **Subnet mask**
- **Default gateway**
- **DNS server**
- **Proxy**
- **IT diagram**

For a complex project with a high number of chargers or specific IT architectures (ie, different subnet mask, DMZ…) Schneider Electric recommend collaborating with Schneider Electric EcoXpert partners or IT designer and system integrators skilled in communication networks.

(*) For ring topology, the RSTP bridge priority is set to 32768, not modifiable. The bridge priority of the RSTP switch shall so be set to a lower value: for instance 4096.

# EV charging operations

1 2 3 4 5

## 2/ Cybersecurity landscape and rules for eMobility

**Can a charging station be a weakness to access the building network?**
**How can I identify and classify cybersecurity risks?**
**How can the charging infrastructure be stronger and more resilient in case of cyberattacks?**

### eMobility threatscape

Cybersecurity is all the laws & regulations, human behavior, technical measures, good practices and technology that are leveraged to protect people and assets interacting with digital technology against malicious activities.

Cybersecurity attacks leverage different vectors and have different impacts, depending on their nature. They can be Information Technology attacks, such as data theft and ransomware, or Operational Technology attacks, which can disrupt business continuity, charging or transportation service availability.

The growing media exposure related to cybersecurity for eMobility in general, and thus to the Schneider Electric eMobility portfolio, draws the interest and attention of EV security researchers.

By 2030 **84%**
**of Charge Points are expected to be connected**

Connected devices which are physically accessible are entry points for malicious actors.

Attack surface and threats are growing with the market.

### Actors' main concerns

**Building Owners, Facility Managers, DSI Managers want:**

- Holistic solution: secured by-design, robust, open and cost effective
- Up and running EV charging infrastructures
- No access point to critical data and systems (BMS, users' information, including billing, utilities etc.)
- Compliance with regulations and standards
- A scalable EV architecture

**Charge Point Operators and Mobility Service Providers want:**

- The best serviceability: low risk of cyberattacks and fast incident response
- Devices, system and data integrity
- Real-time monitoring and history back-up
- Remote access capability for troubleshooting and maintenance on the infrastructure, or when a firmware upgrade must be deployed on the installed base

**Electrical contractors want:**

- Guided configuration for network installation, settings and commissioning
- Cyber-secured and built-in connectivity
- Remote access capability for troubleshooting or mass-firmware upgrades

**EV drivers need:**

- Car and station integrity
- Data integrity
- Easy service available 24/7

# EV charging operations

## Regarding eMobility, the whole ecosystem should be evaluated

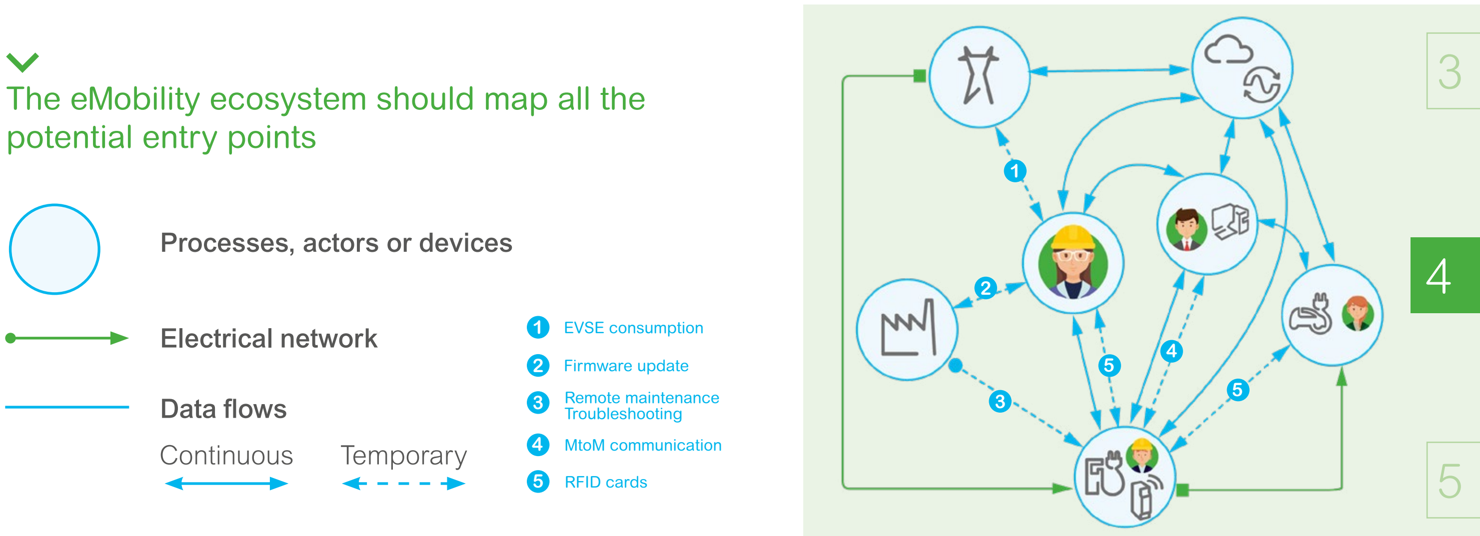
Going fast often leads to allowing breaches in solutions, while the number of actors and a high degree of connectivity and data exchange with other digital assets increases the attack surface and multiplies the potential entry points that are targeted by more and more threat actors[1]. Malware can result either in loss of data or equipment functionalities, impacting more or less all mobility stakeholders with the potential to significantly damage the business.

Some tools that can be used to evaluate the threastscape are given below:

### Identification of priorities : fundamental risk matrix

Level of risk is expressed as a combination of the likelihood of an event occurring and the impact on the business expressed in the equation. Such a risk matrix can be used to identify starting points when addressing or deploying a cybersecurity program.


### The eMobility ecosystem should map all the potential entry points




### Some vulnerabilities and potential impact

| eMobility ecosystem vectors | Nature of threats | Potential impact |
|---|---|---|
| Utilities and Grid | • Outdated components, lack of protection on industrial network<br>• Interdependance between IT software linked to grid operation (eg. billing server) | • Grid instability |
| Data Exchange Plateforms | • Unsecure data exchange (no authentication, no integrity check, no encryption…)<br>• Unsecure cloud platform configuration (no segregation, database protection…) | • Data breach impacting brand reputation<br>• Cloud compromise enabling malicious remote control and unavailability of charging services |
| Charging station and connected equipment (IoT) EV Supply Equipment Manufacturer | • Unsecure devices (outdated firmware, no authentication, no integrity check, no encryption…)<br>• Unsecure development environment (no segregation, no source code protection, no Principle of Least Privilege (PoLP)) | • Product weaknesses leading to charging service unavailability or intrusion inside the building network<br>• Owner/CPO reputation |
| Electric Vehicle | • Unsecure data exchange with the charging station (broken wire) | • Product weaknesses leading to charging service unavailability or damage to equipment/EV |

[1] Regarding the EV market, threat actors are individuals, groups or organizations that operate with malicious intent causing a cyber incident. Examples of threat actors include Nation-state actors, terrorits, activists insiders or malicious competitors.
[2] Schneider Electric actions to limit threats are based on IEC62443 standard and Schneider Electric strategy and policy.

# EV charging operations

**Are there any rules I can leverage to protect people, data and assets?**

eMobility remains a new fast-growing market with many stakeholders interacting together but, as yet, no established cybersecurity standards.

Still, Alternative Fuel Infrastructure Regulation (AFIR) and Academic cybersecurity research[1] in this domain have provided comprehensive inputs.

Furthermore, industries and governments worldwide recognize the need for a common ground on cybersecurity in EV infrastructure; Schneider Electric also agrees with them that a standardized and regulated approach will enable consistent cybersecurity approach across the Smart Charging Infrastructure.

> *"The lack of common technical specifications constitutes a barrier for the creation of a single market of alternative fuels infrastructure.*
>
> *Therefore, it is necessary to lay down technical specifications for areas where common technical specifications are required but do not yet exist.*
>
> *In particular, those technical specifications should cover the communication between the electric vehicle and the recharging point, the communication between the recharging point and the recharging software management system (back-end), the communication related to the electric vehicle roaming service and the communication with the electricity grid, while ensuring the highest level of cybersecurity protection and protection of the end customers' personal data."*

Refer to Alternative Fuel Infrastructure Regulation

## IEC 62443, existing and upcoming standards

The primary goal of the ISA/IEC 62443 series is to provide a flexible framework that makes it easy to address current and future vulnerabilities in IACS and apply the necessary mitigations in a systematic, defensible manner.

It is important to understand that the intention of the IEC 62443 series is to build extensions to enterprise security that adapt the requirements for business IT systems and combine them with the unique requirements for strong availability needed by IACS. The functional requirements include:

- Identification and authentication
- Use control
- System integrity
- Data confidentiality
- Restricted data flow
- Timely response to events
- Resource availability

Even without a consistent cyber approach across the EV infrastructure, existing regulation can be leveraged, such as UK and Eichreicht regulations based on common cybersecurity guidelines at EU level (ETSI 303 645), the Cyber Resilient Act and Network Information Security directive (NIS2).

[1] Through Academic cybersecurity research, Schneider Electric appreciates researchers that have responsibly disclosed vulnerabilities and recognizes their contributions on the company wall of thanks.

# EV charging operations

**How does Schneider Electric address cybersecurity?**
**What are Schneider Electric's recommendations to protect my EV infrastructure?**
**How does it apply to Schneider Electric eMobility solutions?**

## Schneider Electric's corporate strategy

Schneider Electric stands out as a pioneer in cybersecurity. The company was one of the first industrial leaders to consider that threats can't be limited to a single company, industry or region with a strong belief that the most effective way to change global cyber culture is to encourage a collaborative approach to:

- Educate the ecosystem[1]
- Help to secure value from the company's posture to suppliers and partners
- Achieve systemic impact and change by engaging on a global to local scale

### Schneider Electric Cybersecurity Portal

Vulnerability management policy

Security notifications

## Schneider Electric's policy

Schneider Electric's cybersecurity management policy addresses vulnerabilities that can affect products in order to support customers. The company collaborates with researchers, Cyber Emergency Response Teams (CERTs), and asset owners to enable that accurate information is provided in a timely manner that adequately helps to protect installations. Schneider Electric's Corporate Product CERT (CPCERT) is responsible for managing vulnerabilities and mitigations affecting products and issuing alerts.

**The cybersecurity of our offers and data privacy care are integral to Schneider Electric's business strategy, with publicity and operational results in day-to-day activities.**

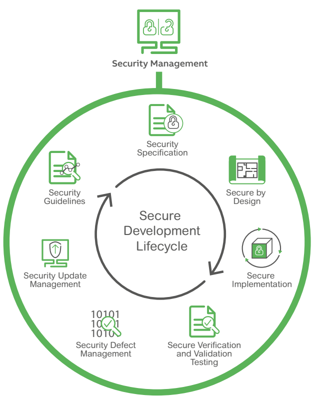
### Managing Data Privacy

Data is the lifeblood of our Digital Ecosytems. To govern it Schneider Electric commits to create, ingest and consume data applying a holistic Data Risks Management framework, anticipating and answering regulations and potential exposures.


LEARN MORE

### Managing Product Development

To support the development and maintenance of products, Schneider Electric follows a Secure Development Lifecycle (SDL) compliant with the IEC 62443-4-1 Security Standard for Industrial Automation and Control systems.

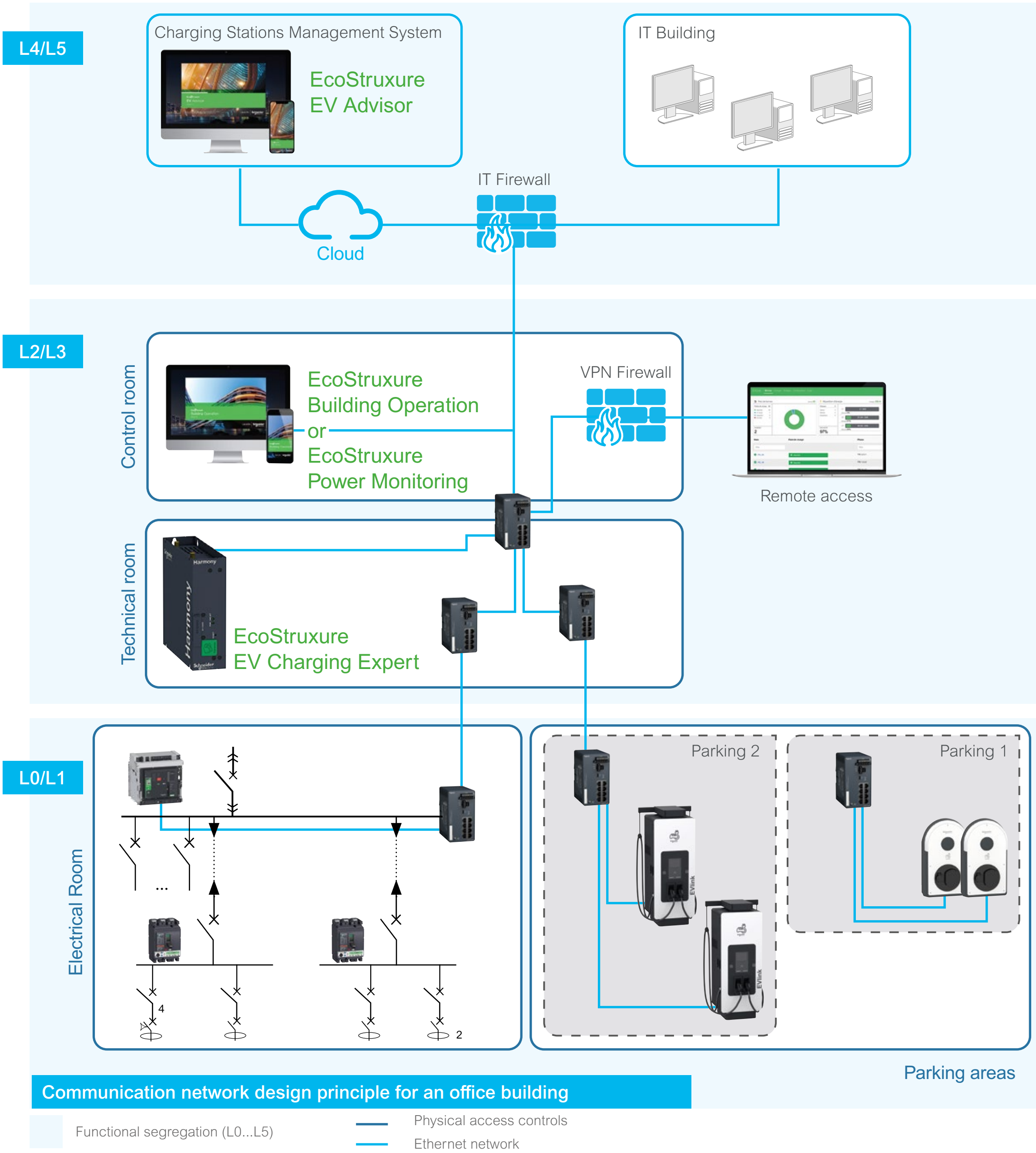



LEARN MORE

(1) To learn more about how to secure the environment and infrastructure in which the eMobility building application is deployed, Schneider Electric publishes guidelines, white papers, and best practices that can be consulted in the Cybersecurity Solutions page of the Schneider Electric global website.

# EV charging operations

## Schneider Electric's policy applied to eMobility solutions




Communication network design principle for an office building

The communication network of the eMobility building application shall consider the cybersecurity requirement and network communication constraints coming from the building's global IT network e.g. network IP addressing, segmentation (VLAN), firewall, external commutation link (VPN, IPSEC).

# EV charging operations

From the design phase to the operation and maintain activities, OT and IT infrastructures should be managed globally leveraging cybersecurity best practice throughout that helps to prevent any compromise of system availability, integrity and confidentiality.

## Schneider Electric's recommendations for improving eMobility cybersecurity

### Efficient cybersecurity mindset

- Multiple potential attack vectors
- Many different actors involved
- Huge business cost impact
- Evolving standards and regulations

- [ ] Control physical access to cabinets
- [ ] Change default passwords at first use to avoid unauthorized access to device settings, controls, and information
- [ ] Use Web Socket Secure (WSS) or HTTPS to optimize a secure communication between the EV charger and the Charging Station Management System (CSMS)
- [ ] Consider functional segregation that enables network separation (VLAN) by using switches instead of unmanaged systems, between the operational network and maintenance network
- [ ] Implement network filtering with firewall and monitoring to control internal and external communication flow
- [ ] Anticipate secure remote access needs for troubleshooting and maintenance
- [ ] Keep the firmware up-to-date for all devices
- [ ] Deliver a cartography and device inventory with network flow architecture
- [ ] Consider end of life to anticipate cybersecurity risk associated with legacy product, for example through Schneider Electric services offers
- [ ] Apply recommendations for all products and systems during the solution's lifecycle

# EV charging operations

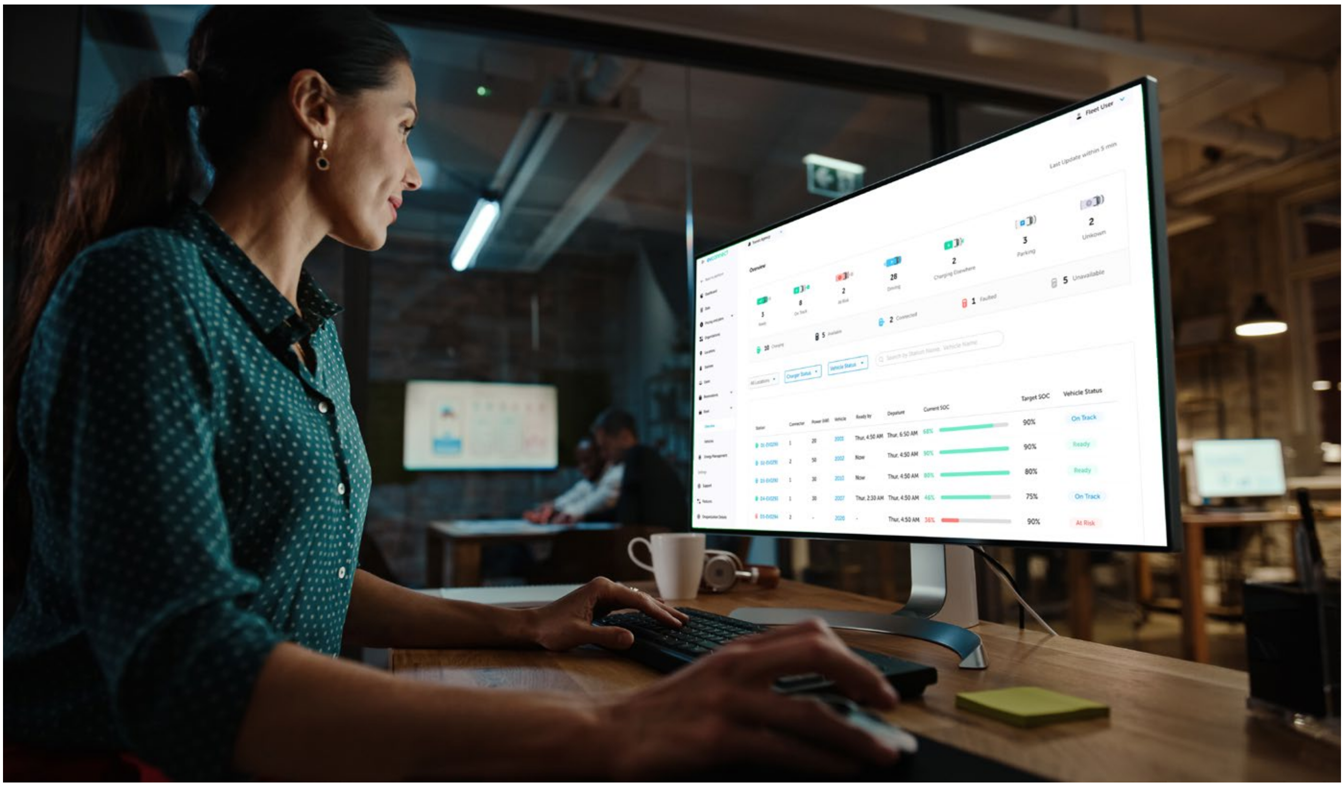
## 3 Cloud-based Supervision Systems

**What opportunities are offered by supervision connected to the EV infrastructure?**
**What are the technical and communication prerequisites for deploying such a solution?**
**Is it an open or locked solution?**

With a supervision system, you can remotely monitor and manage all your chargers on your sites from one single platform. You will get a global overview and the capability to deep dive on a site to manage chargers, Load Management Systems, or EV drivers' usages.

Charging infrastructure can be connected either via a local network or with a 4G modem connection. It can enable access to the platform to be allocated according to roles or responsibilities and provides separate or combinable logins to commission, maintain and operate the EV charging infrastructure.

In addition, some systems provide an EV Driver app with features designed to improve the EV drivers' charging experience.



1 2 3 4 5

# EV charging operations

Focus
on technology

## EcoStruxure™ EV Advisor


1
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# EV charging operations

1 2 3 4 5

## 4/ Payment of the charging session

**What payment solutions should I offer to my customers, especially those who don't want any eMSP contract?**
**How can EV charging point operators comply with the requirements of the new modes of payment?**

### Payment terminal integrated in an EV Charging infrastructure:

The AFIR regulation enforces the right of EV drivers to charge their car on an ad-hoc basis to pay easily and conveniently via payment instruments that are widely available in Europe, publicly accessible charging points and without signing a contract with an operator or a mobility service provider.

The EVlink Pro Pay payment kiosk, fully aligned with the above requirement, enables Charge Point Operators to offer their customers a seamless and contactless payment experience with the widely used credit and debit cards, either with physical cards or via a digitized wallet.

### How does EVlink Pro Pay payment kiosk comply with AFIR standards?

| | |
|---|---|
| Easy and compliant ad hoc payment | • Convenient contactless payment experience with Pin entry if needed.<br>• 3" color touch screen to simply select the charge point and display the associated pricing policy.<br>• Widely used payment instruments such as VISA, Mastercard, Apple Pay or Google Pay are accepted. |
| Openness and simplicity | • Back-end interfacing with any compatible Charging Station Management System (CSMS)* platform thanks to cloud connectivity.<br>• Flexible installation on new or existing EV infrastructure with no any impact on the charging stations.<br>• Embedded 4G modem and SIM or LAN makes it ready for connectivity. |
| Cost effectiveness and reliability | • Ad hoc payment capability for multiple charging points, both AC and DC, avoiding the need and the complexity of dedicated screens on each charger. |

*Check with your CSMS provider that they support Payter Apollo terminals in kiosk mode.

Focus on technology

### EVlink Pro Pay solution

EVlink Pro Pay offers an ad-hoc payment kiosk that can manage up to 15 charging points, is compliant with AFIR regulation and fully integrated with EcoStruxure EV Advisor.

# EV charging operations

## Payment terminal embedded into a charging station

While it is possible to install a payment terminal separately from the DC charger (as is the case with the EVlink Pro Pay solution), embedding the payment terminal directly into the DC charger offers an all-in-one solution which is easy for EV drivers to use and which also complies with the AFIR regulation on public charging stations.

In this way, EV drivers can complete authentication, make payments and charge their vehicles from a single device.

Focus
on technology

### EVlink Pro DC 180kW with Credit Card Reader

Payments can be made via the payment terminal in EVlink Pro DC 180.
This solution also offers other functions to meet customers' needs including:

- Requesting a PIN code, if necessary
- Displaying the charging price
- Providing an electronic receipt, by displaying a QR code

# EV charging operations

## 5 / Supervision through Facility Management Systems

**What information does the Facility Manager look for?**
**Is it an open or locked solution?**

The digital age is rapidly transforming how we manage the places where people spend up to 90 percent of their time: buildings. As the Internet of Things connects more devices within buildings, the amount of building management data is increasing exponentially.

How that data is used to create smart buildings is improving what matters most – increasing operational efficiency and improving the occupant experience.

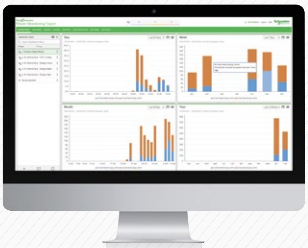
### EV loads integrated into a Facility Management System

| | |
|---|---|
| All-in-one monitoring of the electrical distribution | • A single interface to supervise and monitor the EV charging infrastructure integrated into the building electrical distribution network.<br>• Detailed alarms to make quick and informed decisions if something happens.<br>• Detailed view of circuit capacity to optimize the electrical distribution and to forecast EV infrastructure evolution. |
| Power demand and Power quality monitoring | • EV charging station status and usage continuous monitoring.<br>• Monitoring of the EV charging stations' power output to control the peak demand.<br>• Power quality view to analyze the impact of DC charging on the ED network and anticipate adverse effects. |
| Energy consumption trends and KPIs | • Identification of the charging stations with the highest consumption.<br>• Consumption comparison per zone, time period, parking usage… |

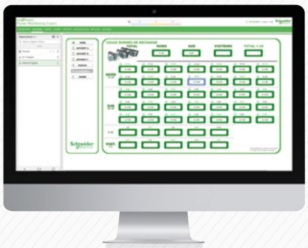
Focus
on technology

## EcoStruxure Power Monitoring Expert

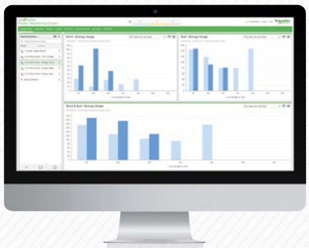
**Facility Manager single and remote user interface**



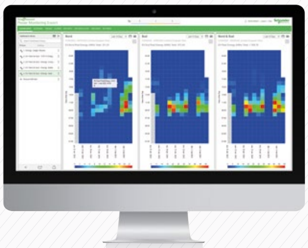
Energy consumption dashboard



Charging stations monitoring

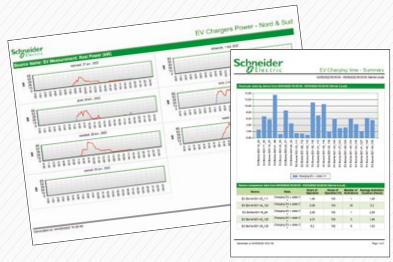


Energy consumption comparison



Heatmaps for deep analyses

Trends



Reports

## EcoStruxure Building Operation

EVSE view

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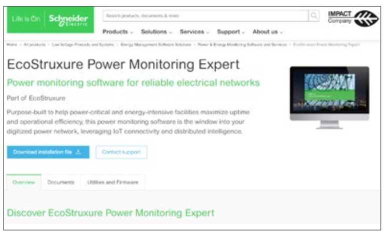
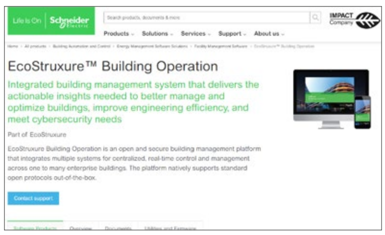
## Learn more




**EcoStruxure Power Monitoring Expert**

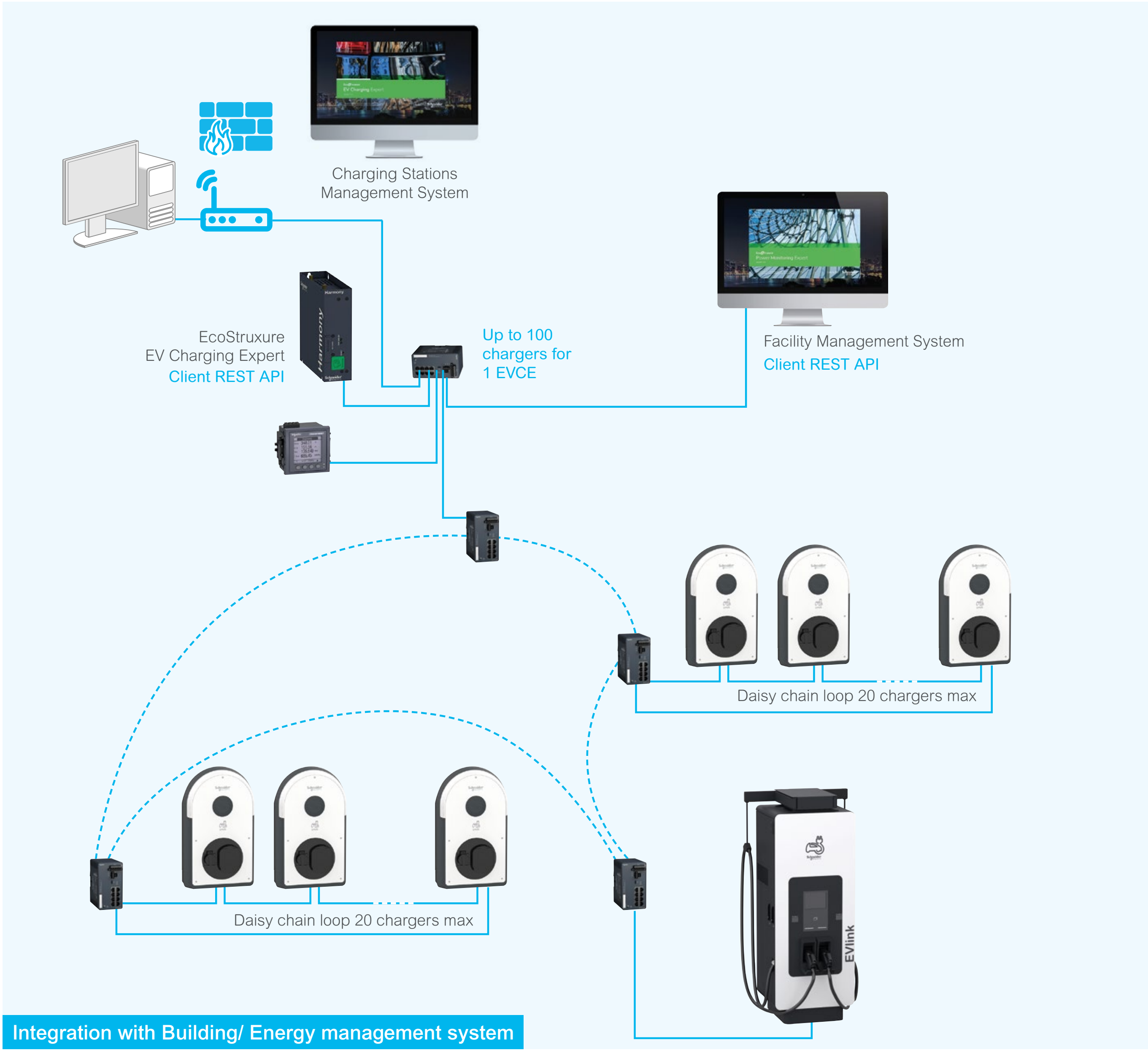



**EcoStruxure Building Operation**

# EV charging operations

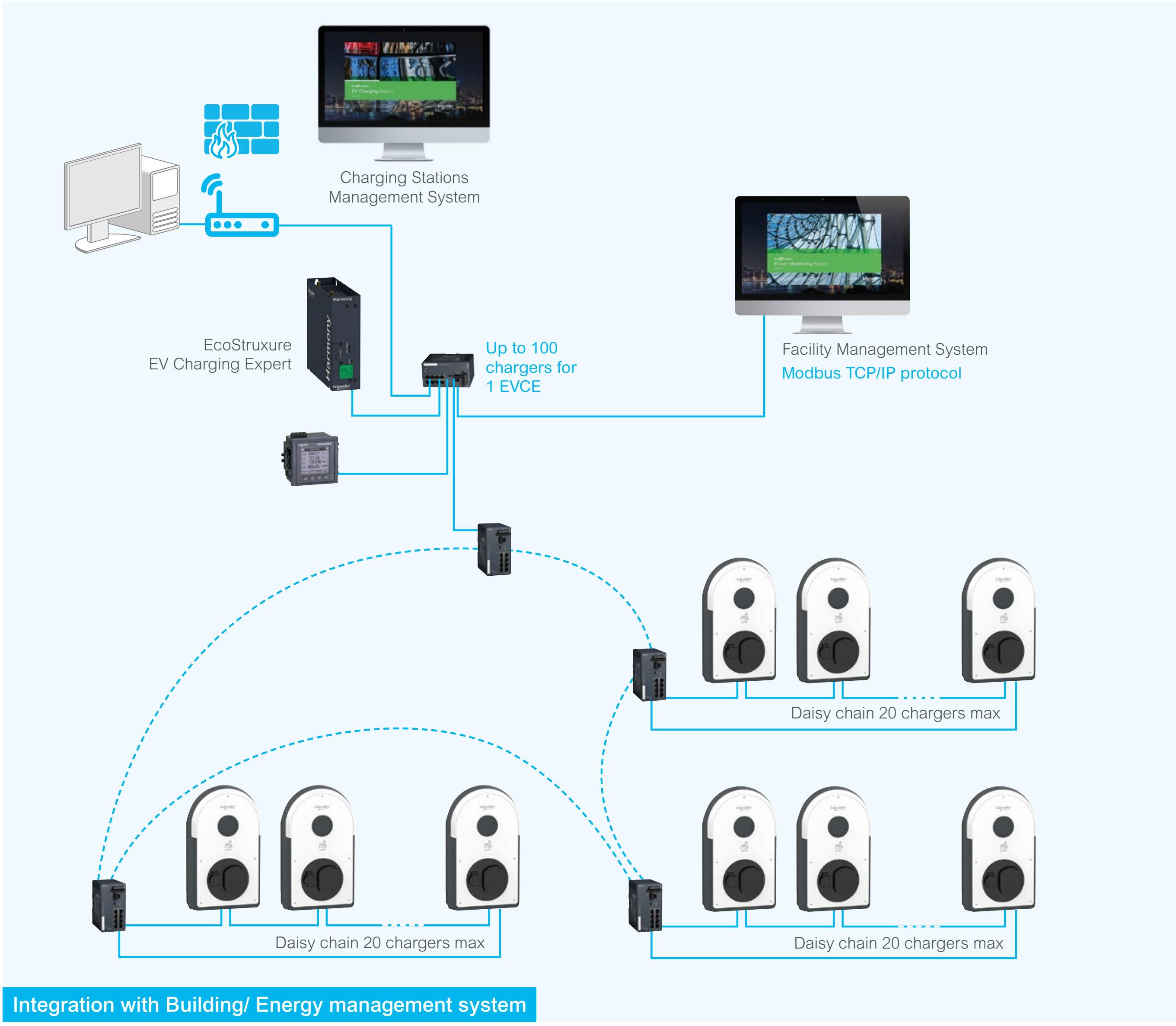
The following illustration details the communication architecture between the EV infrastructure that enables the Charging Point Operator to manage the drivers' access and billing while the Building Management System or the Energy and Power Management System are focused on energy or on operations.

## REST API Communication between EcoStruxure EV Charging Expert and Facility Management Systems

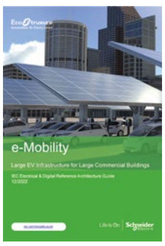


# EV charging operations

## Modbus TCP Communication between EcoStruxure EV Charging Expert and Facility Management Systems




**Facility Management Systems request energy and asset management data in the Modbus TCP/IP protocol with the chargers using the same IP Network that the OCPP protocol between EcoStruxure EV Charging Expert and the chargers.**




For complex projects with a high number of chargers or specific IT architectures (i.e, different subnet mask, DMZ…) Schneider Electric recommends collaborating with Schneider Electric EcoXpert partners or IT designer and system integrators skilled in communication networks.

Large EV infrastructure for large buildings
IEC Electrical and Digital Reference Architecture Guide (EVSOL2DG001)

# EV charging operations

## 6 Service along the infrastructure lifecycle

Services are key to optimizing the performance and uptime of the EV infrastructure and to keep the assets running in optimum conditions throughout the whole lifecycle, from installation and commissioning, to maintenance and modernization.

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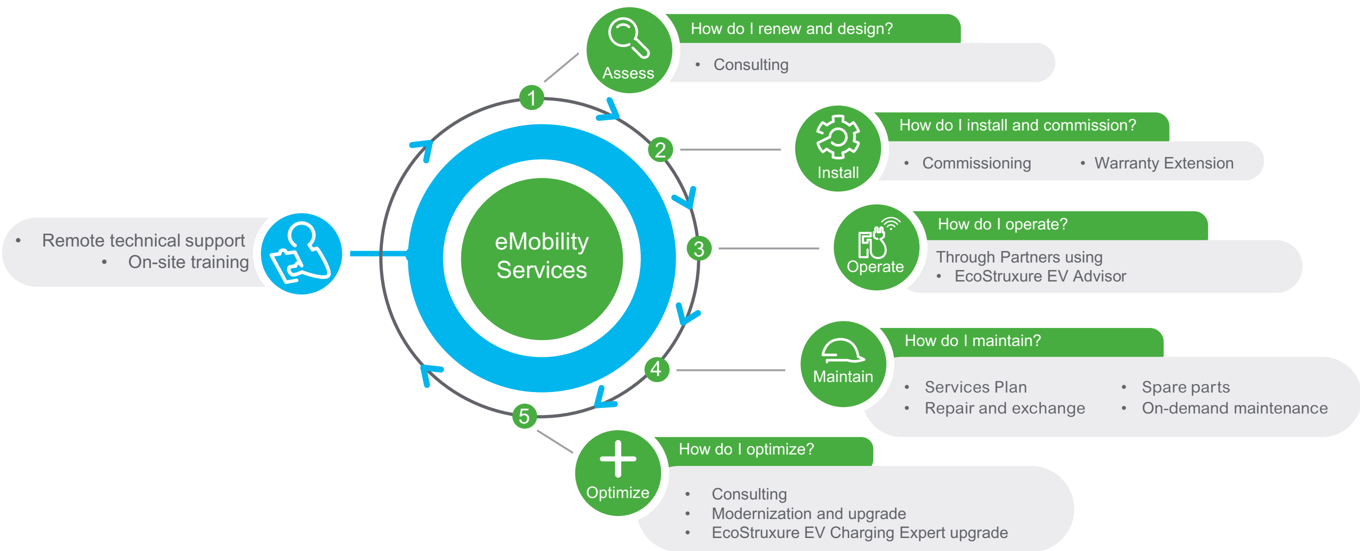


| | |
|---|---|
| Increase uptime | • Optimized business continuity thanks to remote technical support and regular preventive maintenance |
| Optimize investment | • Budget control thanks to a fixed yearly plan for all the maintenance needs and warranty extension |
| Operate in optimum conditions | • Up-to-date features and firmware, and expert advice on the infrastructure optimization |

Focus on technology

### eMobility Services Plan from Schneider Electric

With a fixed yearly plan, you can expect top-of-the-line services from Schneider Electric for your eMobility infrastructure. All that in addition to priority access to on-site and remote support and preferential prices on our spare parts ecosystem.

# EV charging operations

Charge Point Operator
Building owner

## An office building with multiple areas and type of usage

CUSTOMER CASE
illustration #4

### Operation needs:

The operation of the charging infrastructure has been delegated to a charge point operator to maximize uptime of the entire installation while delivering a convenient charging experience for the EV drivers. The building owner and CPO are looking to:

Building owner

**Deliver a smooth charging experience for EV drivers:**
- Locate charge points and access its real time status
- Start and stop the charging session using an RFID card. For visitors, it will be provided by reception

**Maximize uptime of the charger for Private employee vehicles:**
- Inform the CPO in case of issues
- Get visibility on the repair and maintenance activities

**Access to the charging session history, the ability of making money from the EV charging solution:**
- Access the charging session history for each employee
- Define a tariff for chargers open to visitors, and get paid for it

Charge Point Operator

**Monitor and manage charge points remotely:**
- Monitor all the charging points remotely and be notified in case of issues
- Get remote troubleshooting capability and go on site only if necessary
- Upgrade firmware for chargers remotely

**Get an automatic billing and payment process**
- Comply with AFIR regulation

CUSTOMER CASE illustration #1
CUSTOMER CASE illustration #2
CUSTOMER CASE illustration #3
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MORE INFO: EVlink Pro Pay

To enable all the eMobility services required, the EV charging infrastructure is connected to a cloud-based Supervision system.

EcoStruxure EV Advisor

EcoStruxure EV Advisor is an eMobility management platform that enables seamless EV charging for fleets, buildings and destinations.

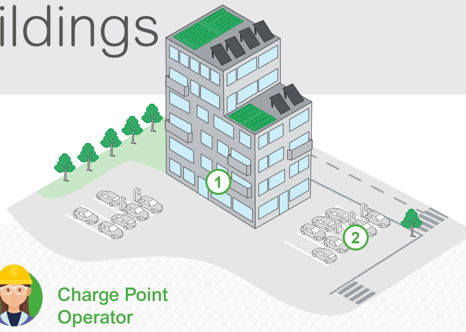
This SaaS offer is built to supply charge point operators, installers, building operators and fleet operators with everything they need to make their operation a successful venture.

Users benefit from supervision and operation functions including features such as asset monitoring and asset control, cloud based static load levelling, EV driver access management and pricing.

# SECTION 5

# How to implement the infrastructure

# Reference architecture for residential buildings




## Design inputs

Building owner

Charge Point Operator

**1.Usages**
- Multi family Home, 40 Flats
- Outdoor parking with EV charging zone
- 10 chargers, 7.4 kW
- Authentication modes: badges for residents

**2.Electrical Distribution**
- EV dedicated switchboard
- EV charging zone:
- CBs for electrical protection installed in the switchboard
- MID meters and RCDs* installed in the charging stations

**3.Power managment strategy**
- Optimizing charging capabilities (LMS): load balancing between building loads and charging stations

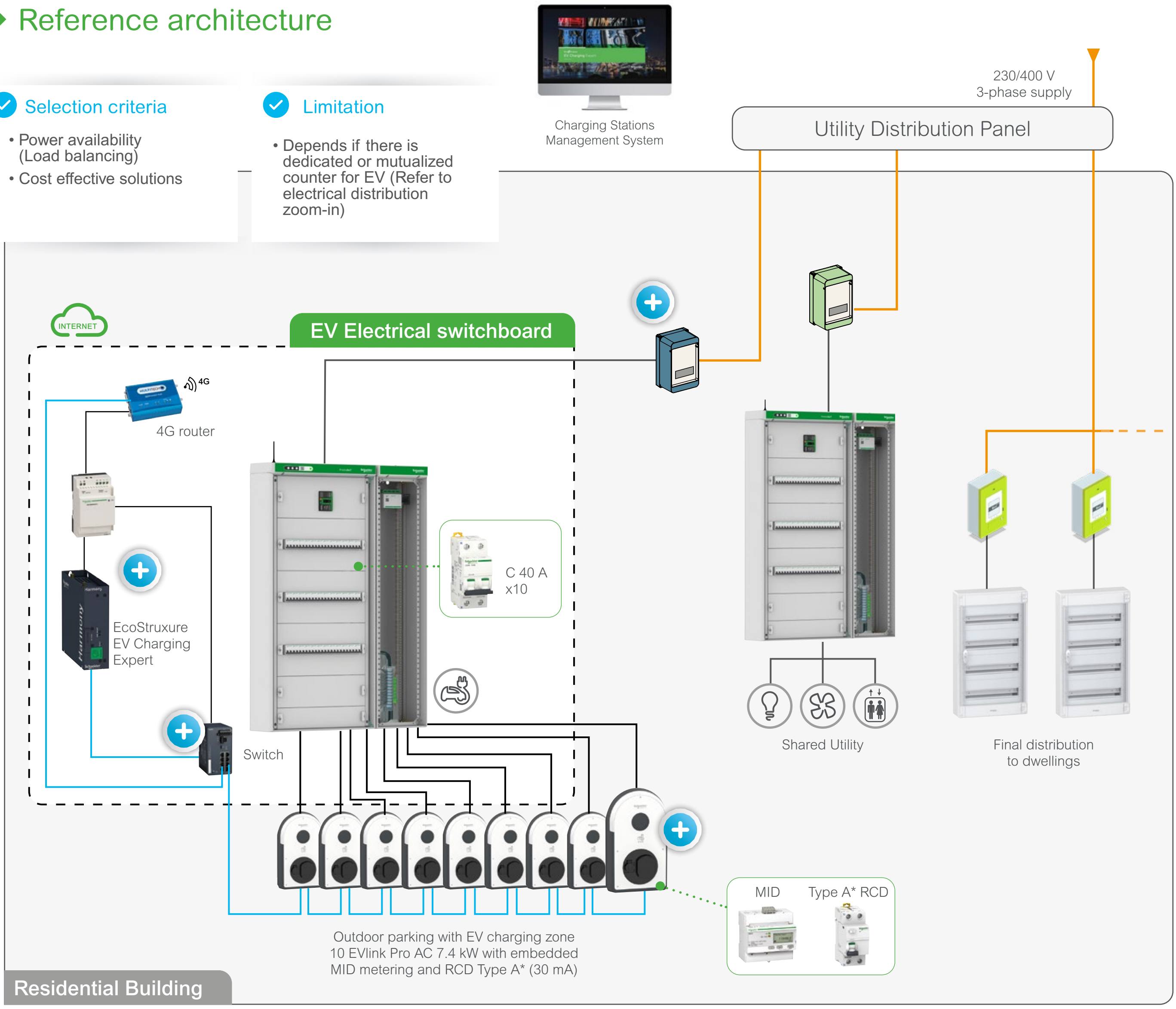
**4.Operational needs**
- EV infrastructure operated by the Charge Point Operator

1 Residential Building
2 Parking with EV charging stations

## Reference architecture

**Selection criteria**
- Power availability (Load balancing)
- Cost effective solutions

**Limitation**
- Depends if there is dedicated or mutualized counter for EV (Refer to electrical distribution zoom-in)

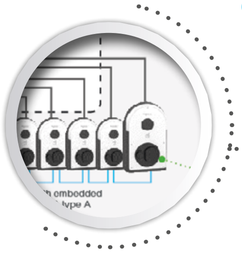



*In countries where the installation standard IEC/HD 60364-7-722 or equivalent local regulations are applied, a RCD type B must be used instead of RCD type A-Si.

# Reference architecture for residential buildings

## Zoom-in

## Alternative usages for faster charge with two possible cost allocations



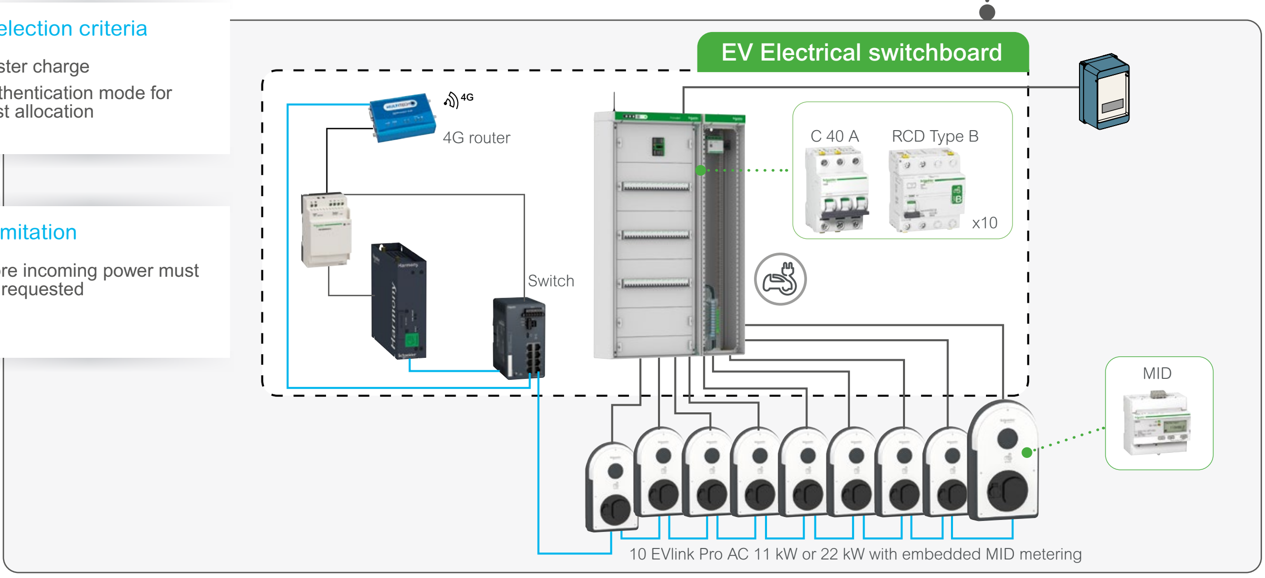
### Implementation of 11 kW or 22 kW charging stations with embedded MID meters.

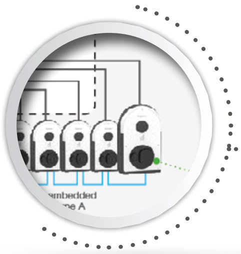
**Selection criteria**

- Faster charge
- Authentication mode for cost allocation

**Limitation**

- More incoming power must be requested

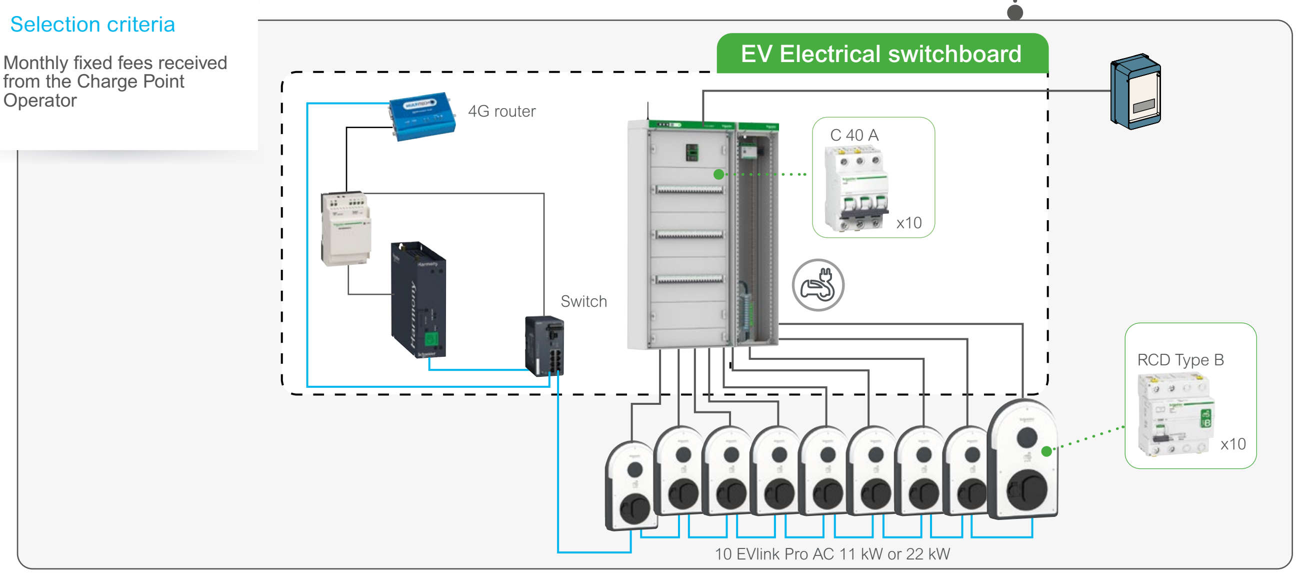


### Variant without MID meters

**Selection criteria**

- Monthly fixed fees received from the Charge Point Operator



# Reference architecture for residential buildings

## Zoom-in Power requirement based on options for electrical zones

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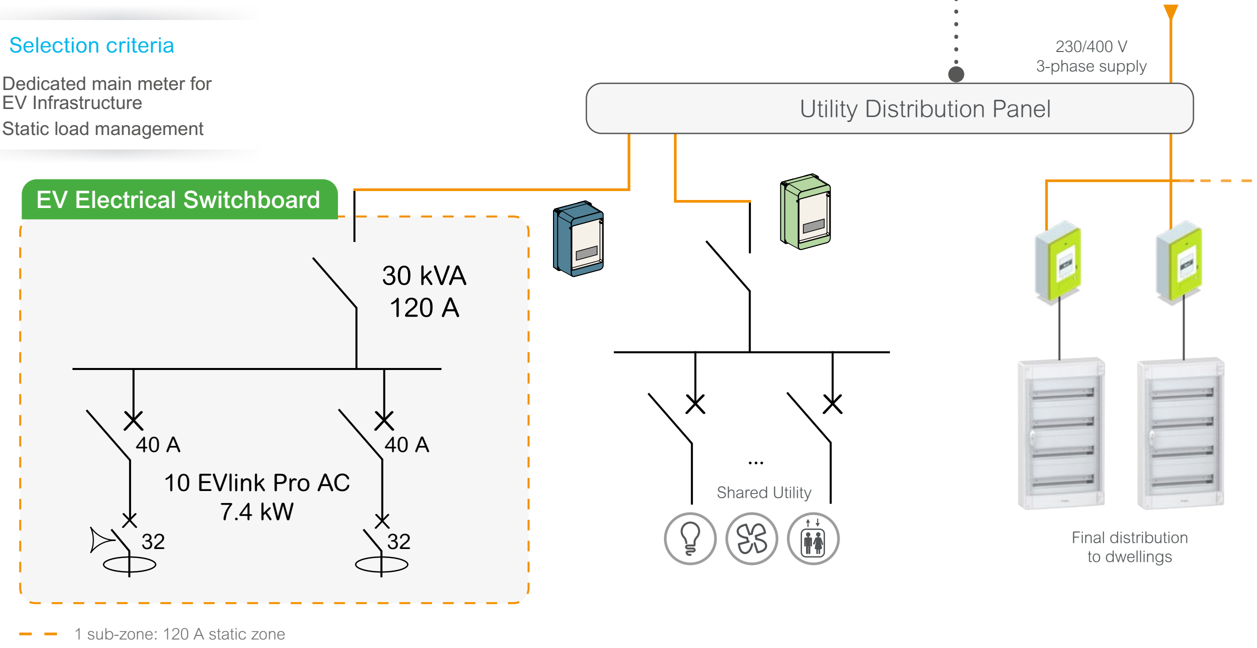
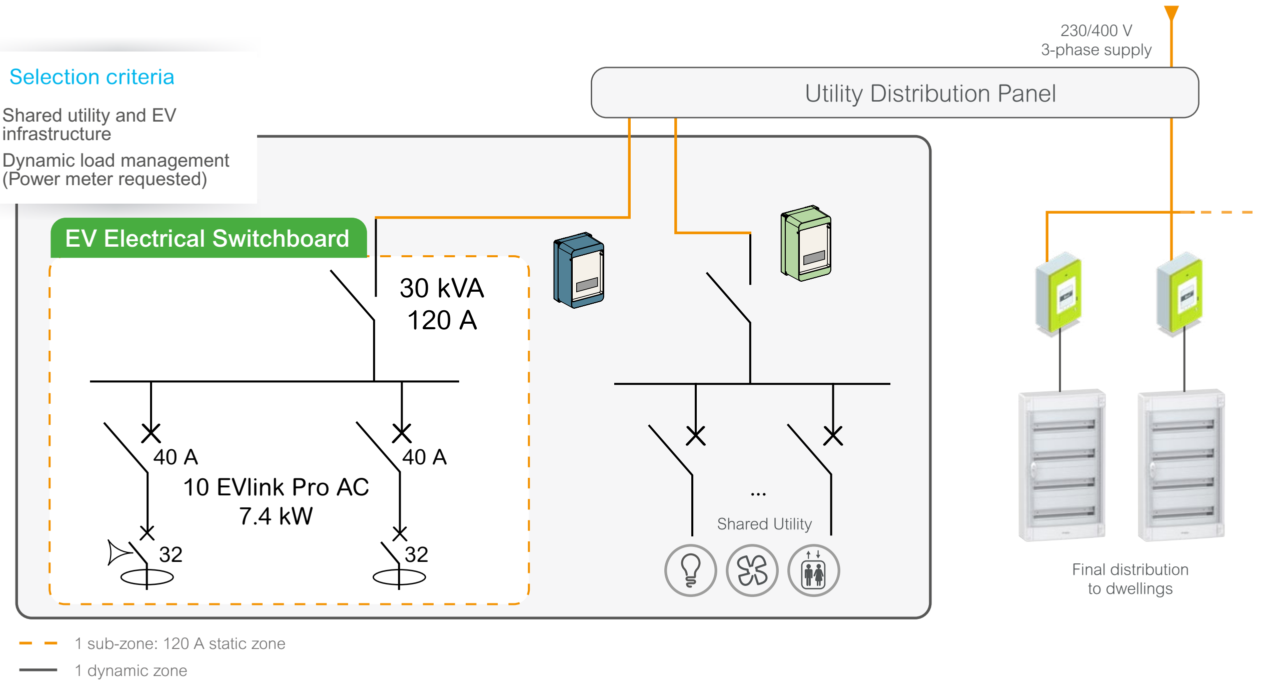
Implementation with 1 dedicated main meter for EV infrastructure.

**Selection criteria**
- Dedicated main meter for EV Infrastructure
- Static load management

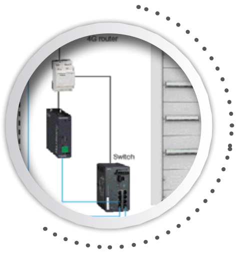



**Selection criteria**
- Shared utility and EV infrastructure
- Dynamic load management (Power meter requested)



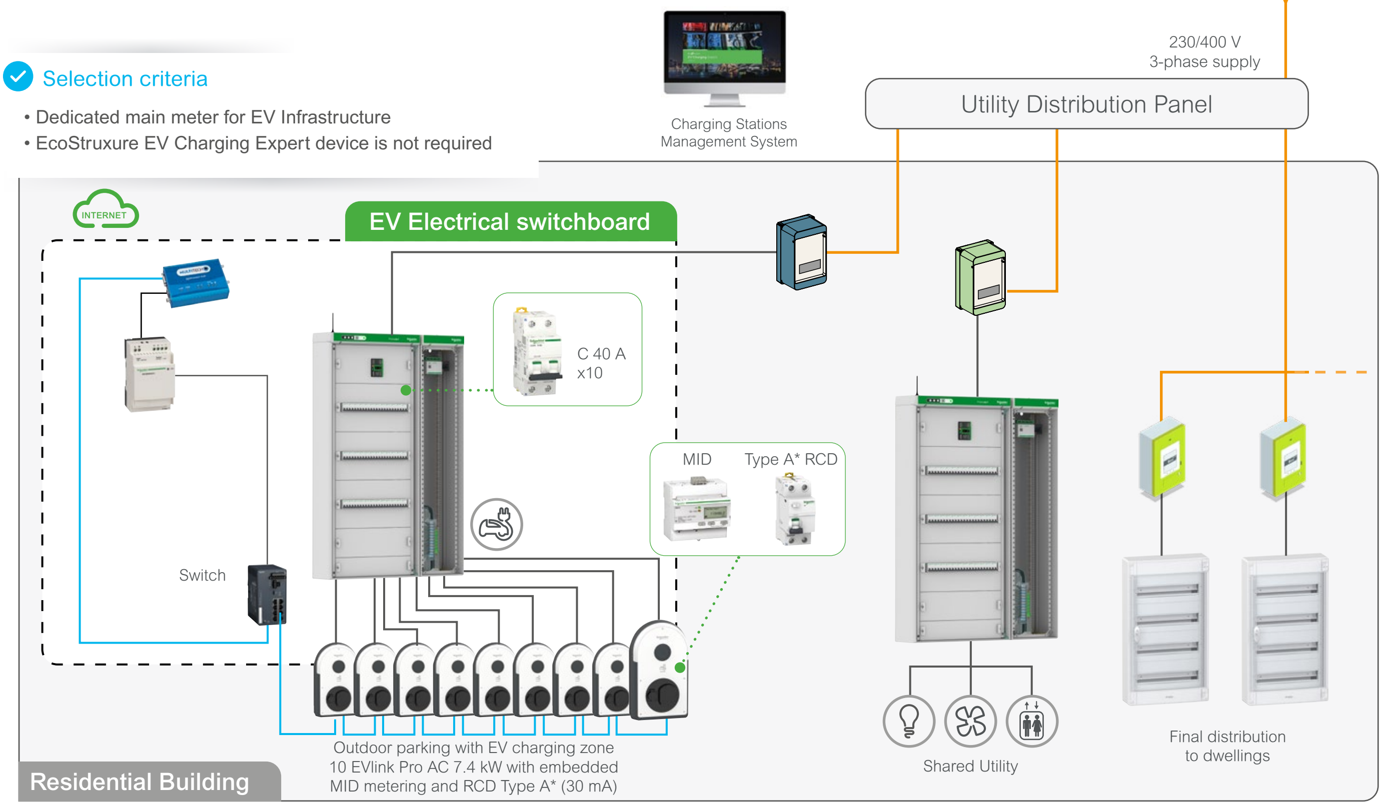
# Reference architecture for residential buildings

## Zoom-in Alternative with cloud-based load management



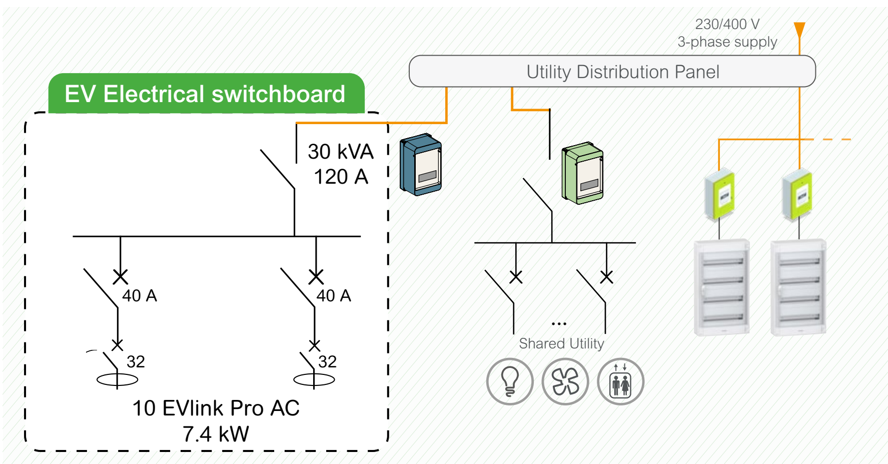
With this architecture the EV load management is managed from the Charging Station Management System.

## Reference architecture




*In countries where the installation standard IEC/HD 60364-7-722 or equivalent local regulations are applied, a RCD type B must be used instead of RCD type A-Si.

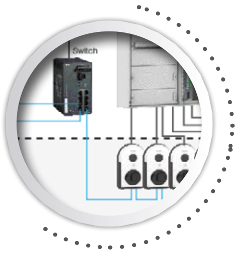
## Electrical diagram



# Reference architecture for residential buildings

## Zoom-in

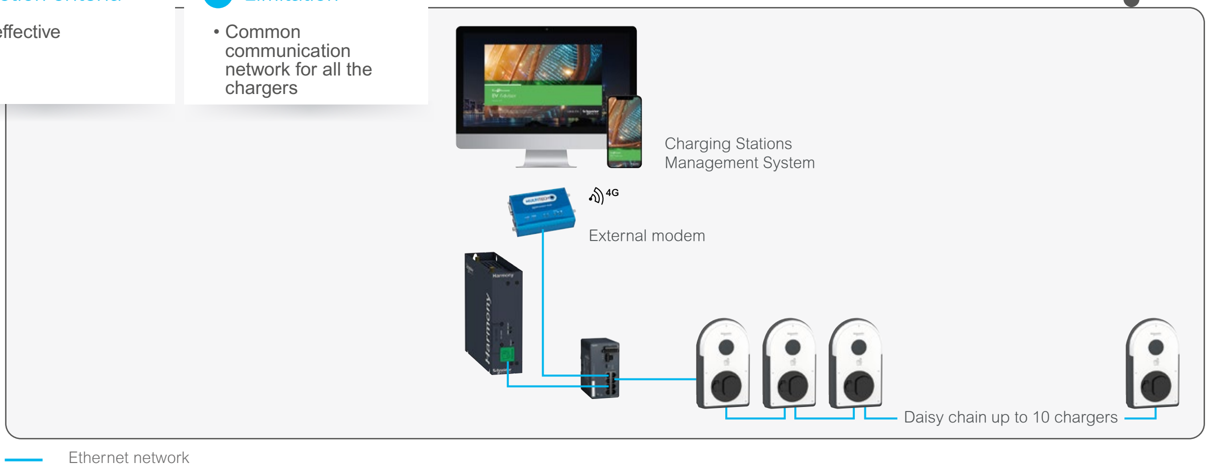
## EV Charging operations optimizing Ethernet network with 4G external modem WAN to Charging Stations Management System

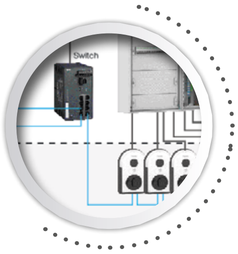


### LAN Ethernet daisy chain connection.

**Selection criteria**
- Cost effective

**Limitation**
- Common communication network for all the chargers

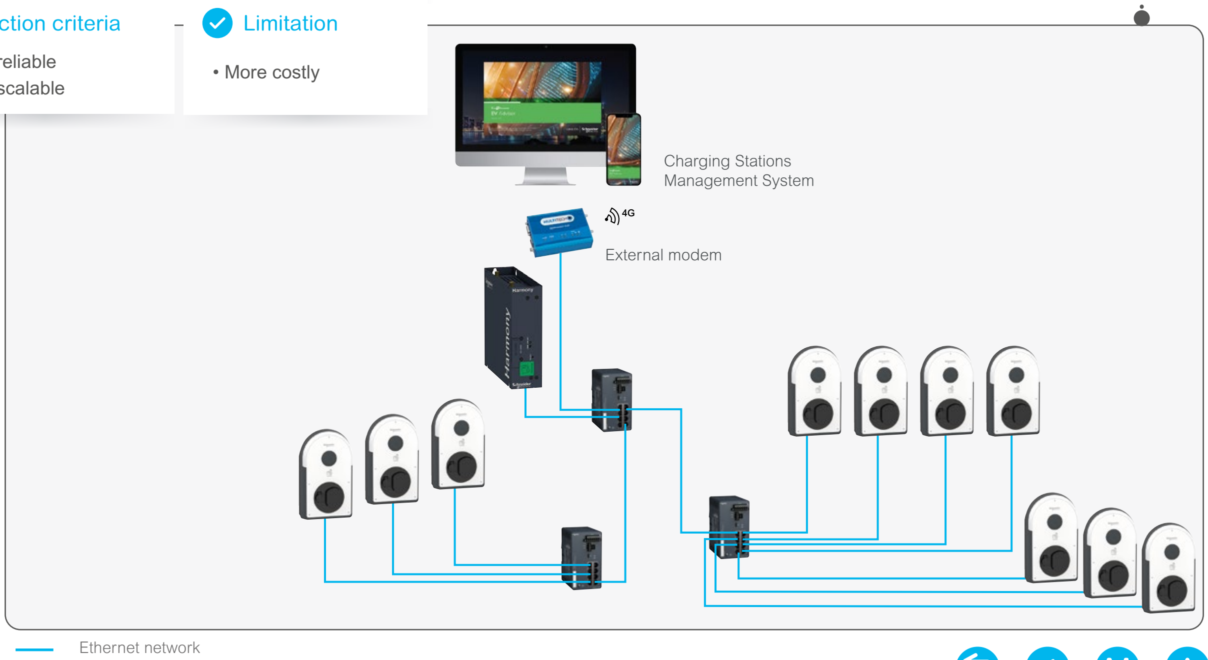


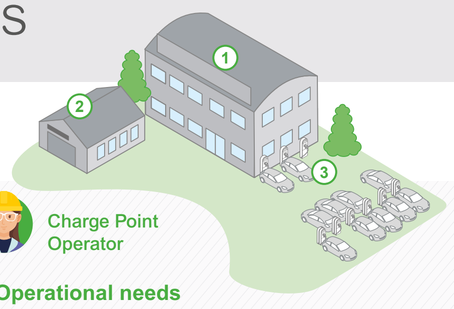
### LAN Ethernet star connection option.

**Selection criteria**
- More reliable
- More scalable

**Limitation**
- More costly



# Reference architecture for office buildings




## Design inputs


**Building owner**


**Charge Point Operator**

### 1.Usages
- New Office building, 5000 m²
- Indoor and outdoor parking
- 25 chargers, 22 kW in total
- Authentication modes:
  - Badges for employees
  - Free charging for visitors

### 2.Electrical Distribution
- EV dedicated switchboards
- Canalis distribution in indoor parking
- Outdoor parking:
  - CBs for electrical protection installed in the switchboards
  - RCDs* installed in the charging station

### 3.Power managment strategy
- Optimizing charging capabilities (LMS):
  - Load balancing between building loads and charging stations (dynamic – main switchboard)
  - Capex optimization by under sizing EV switchboard (static –p1 and p2)

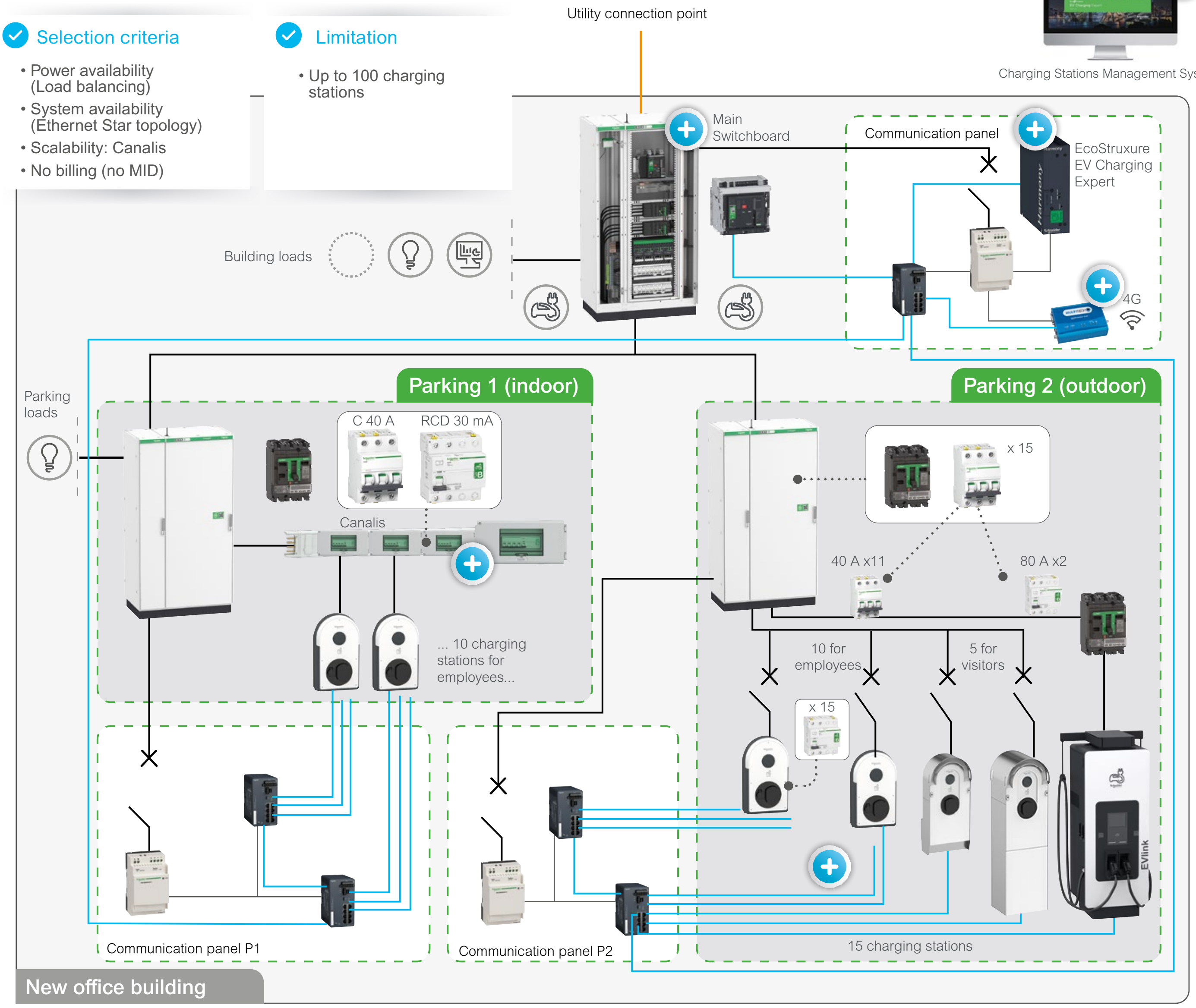
### 4.Operational needs
- EV charging infrastructure operated by Charge Point Operator

1 Office Building
2 Parking 1 (indoor)
3 Parking 2 (Outdoor)

## Reference architecture

**Selection criteria**
- Power availability (Load balancing)
- System availability (Ethernet Star topology)
- Scalability: Canalis
- No billing (no MID)

**Limitation**
- Up to 100 charging stations


Utility network | 24 VDC
Power network | Ethernet network

*In countries where the installation standard IEC/HD 60364-7-722 or equivalent local regulations are applied, a RCD type B must be used instead of RCD type A-Si.

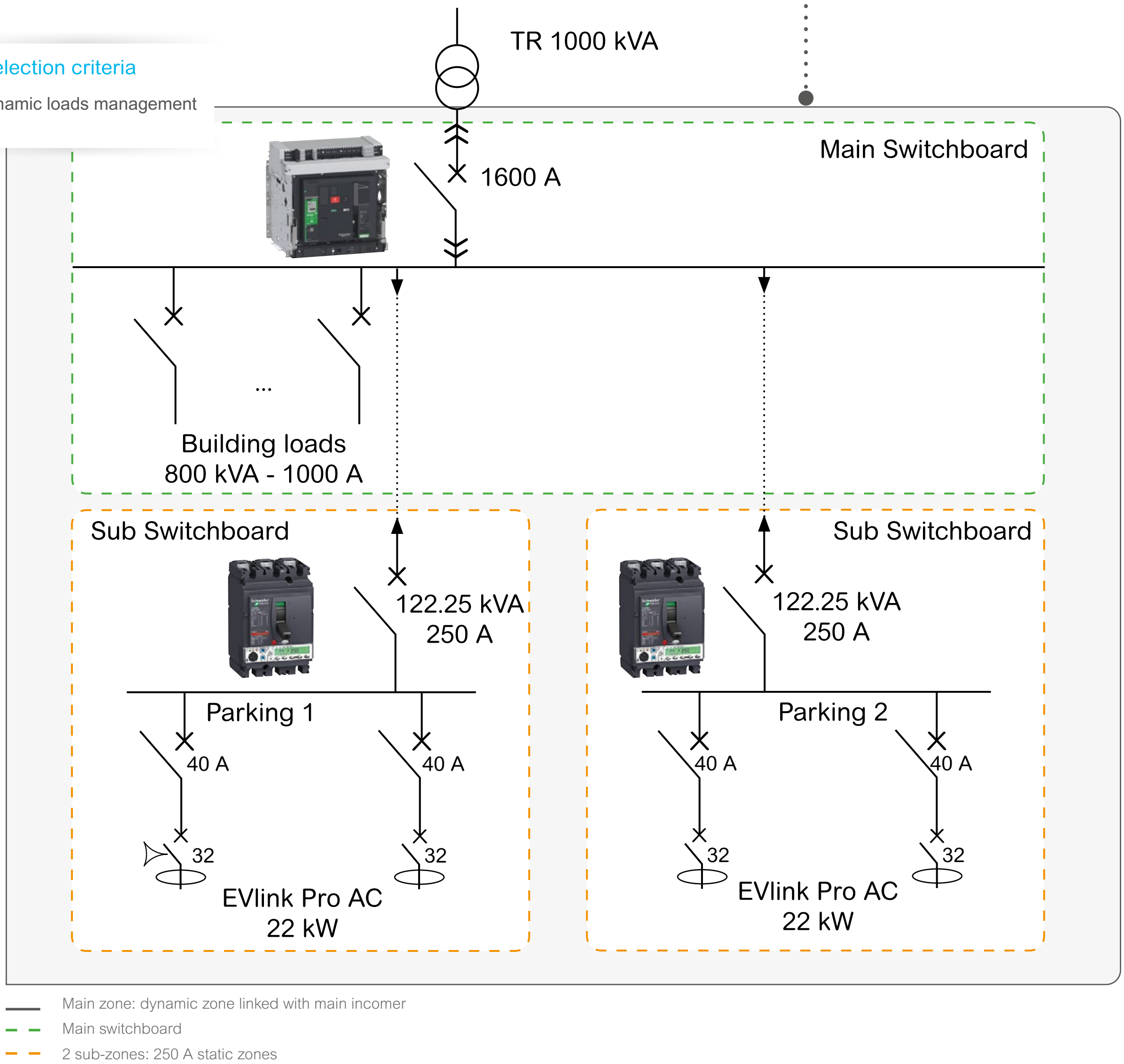
# Reference architecture for office buildings

## Zoom-in Electrical distribution based on options for electrical zones

> Implementation for 1 dynamic zone, with 2 static sub-zones.

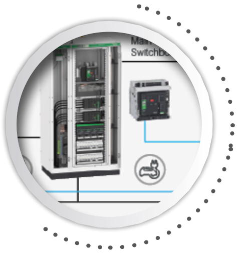
Selection criteria

• Dynamic loads management



# Reference architecture for office buildings

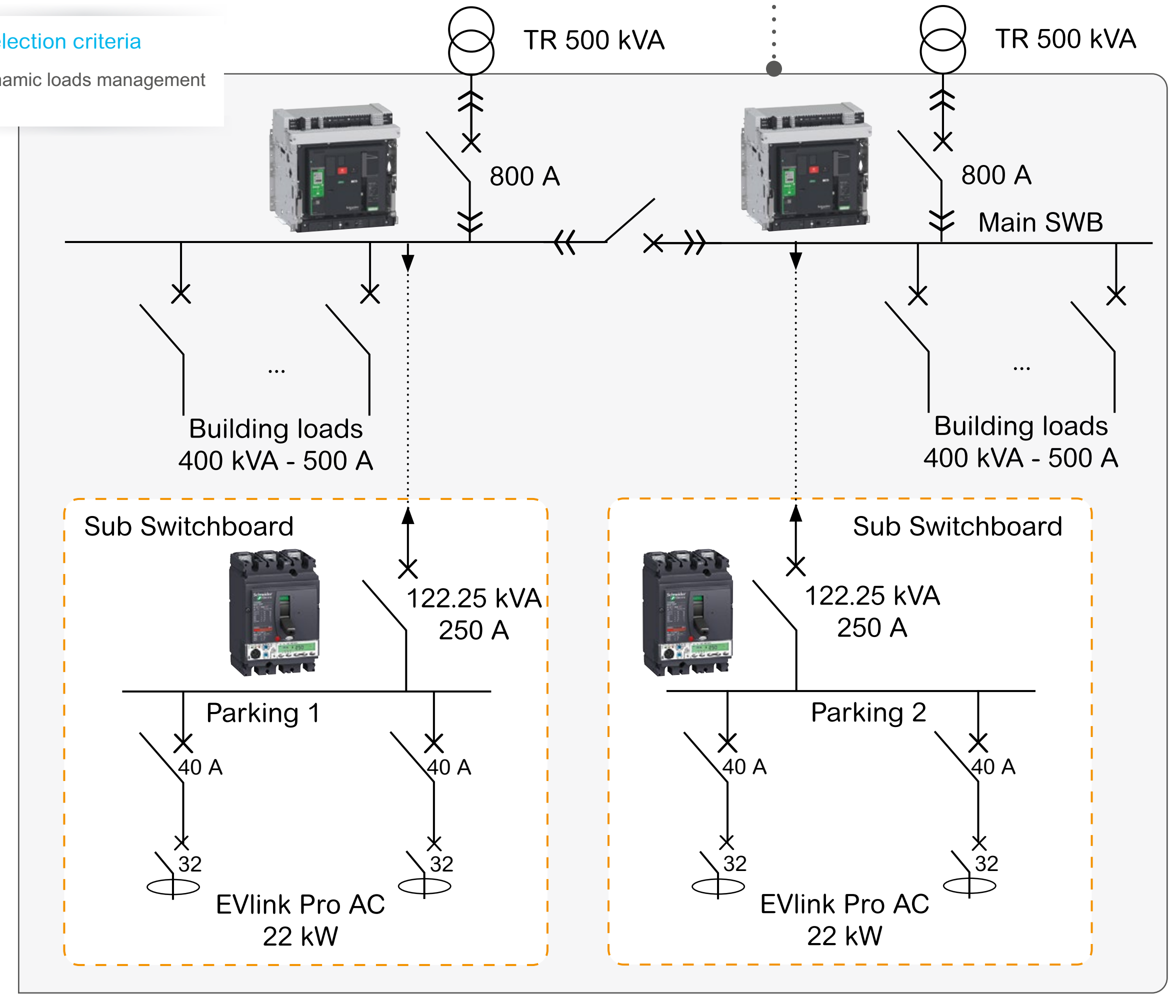
## Zoom-in Electrical distribution based on options for electrical zones



> Complex electrical distribution with multiple incomers and busties.

Selection criteria

- Dynamic loads management




2 zones: 250 A static zones

Note: for complex electrical distribution, contact your Schneider Electric Solution Center.

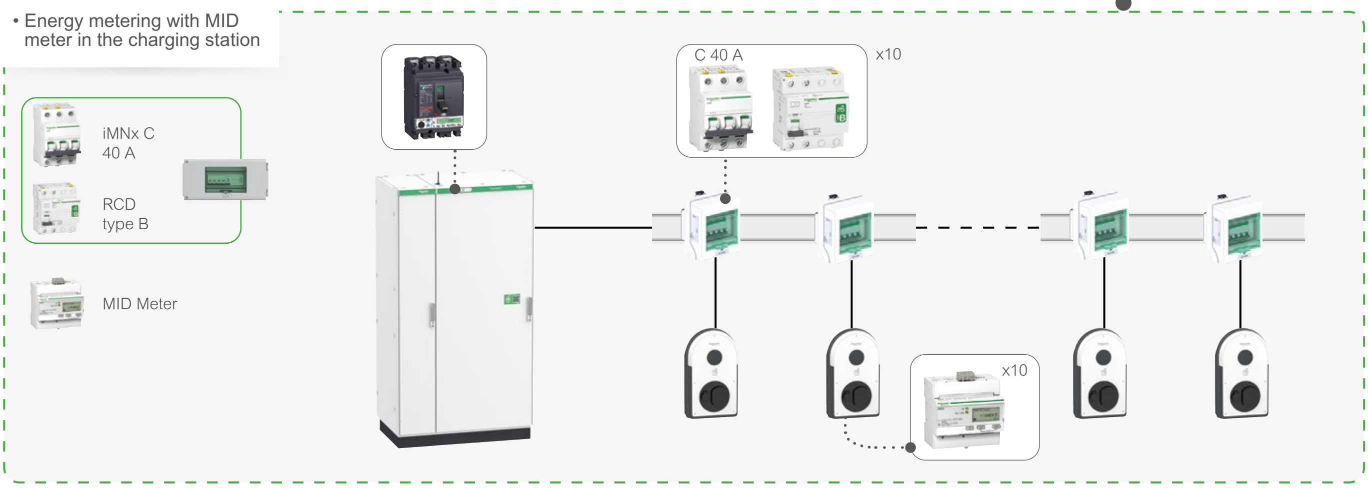
# Reference architecture for office buildings

## Zoom-in Electrical distribution with Canalis distribution system


Possible implementations for indoor parking with Canalis busbar trunking system enabling metering: not connected to ethernet or management systems (EV or Loads).

**Selection criteria**

- Energy metering with MID meter in the charging station



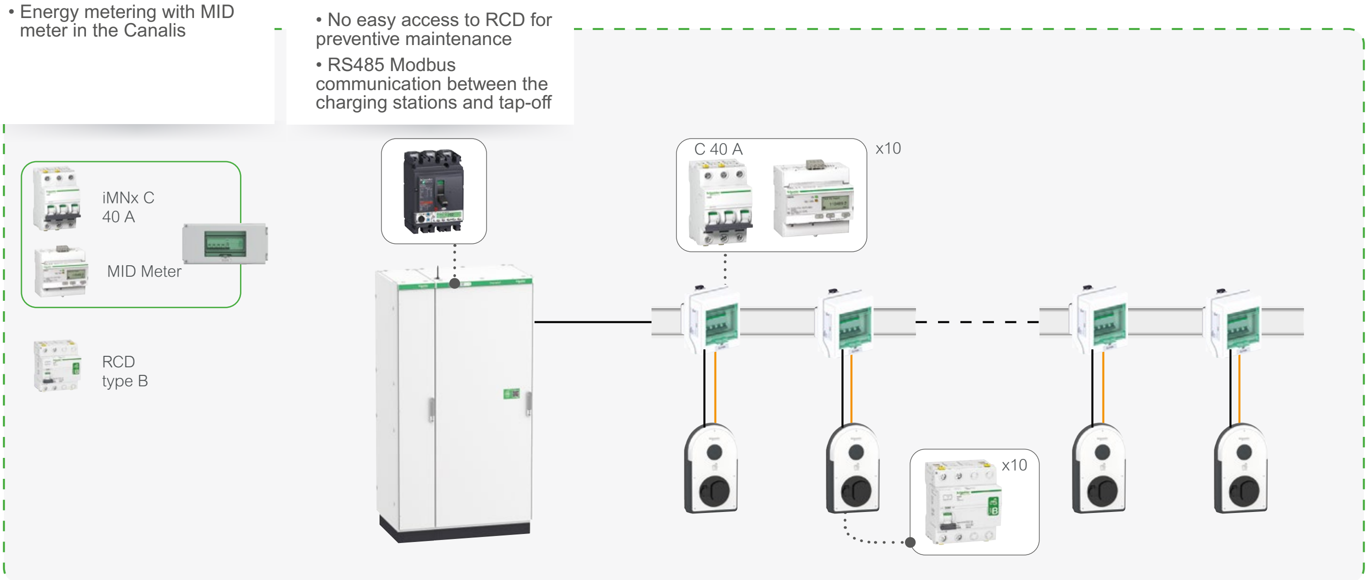

Power network

**Selection criteria**

- Energy metering with MID meter in the Canalis

**Limitation**

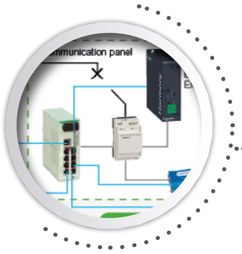
- No easy access to RCD for preventive maintenance
- RS485 Modbus communication between the charging stations and tap-off




Power network
RS485

# Reference architecture for office buildings

## Zoom-in Power management optimizing availability of key loads



### Implementation of dynamic load management in EcoStructure EV Charging Expert.

**Selection criteria**

- Optimizing the power delivered to the EV infrastructure while preserving the building key loads

**Limitation**

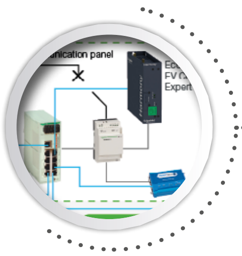
- Dynamic load management requires consumption data from the main switchboard

The power delivered to EV chargers can be managed (Load Management algorithm):

- In Dynamic mode: EcoStruxure EV Charging Expert shall receive the Main Power consumption from the whole building
- In static mode: no need of communication between EcoStruxure EV Charging Expert and the main switchboard

Dynamic load management with local Power Monitoring in EcoStruxure EV Charging Expert brings:

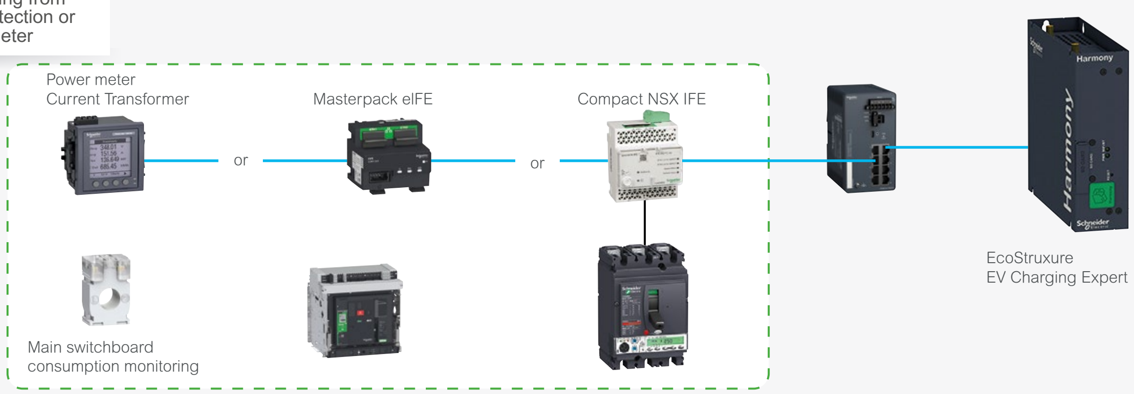
- **More resilience** in isolated mode (cloud disconnection): EVCE as local controller balances the maximum charge capacity among the EVs and avoids the charging points switching to default mode (Maximum power calculated in static mode)
- **Better performance** in case of a large loads (large motor, compressor...)



### Digital implementation of various power meters that can be used to monitor the main switchboard consumption.

**SELECTION CRITERIA**

- Embedded metering from Circuit Breaker protection or additional Power Meter

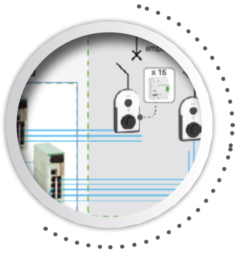



Power network
Ethernet network

1
2
3
4
5

# Reference architecture for office buildings

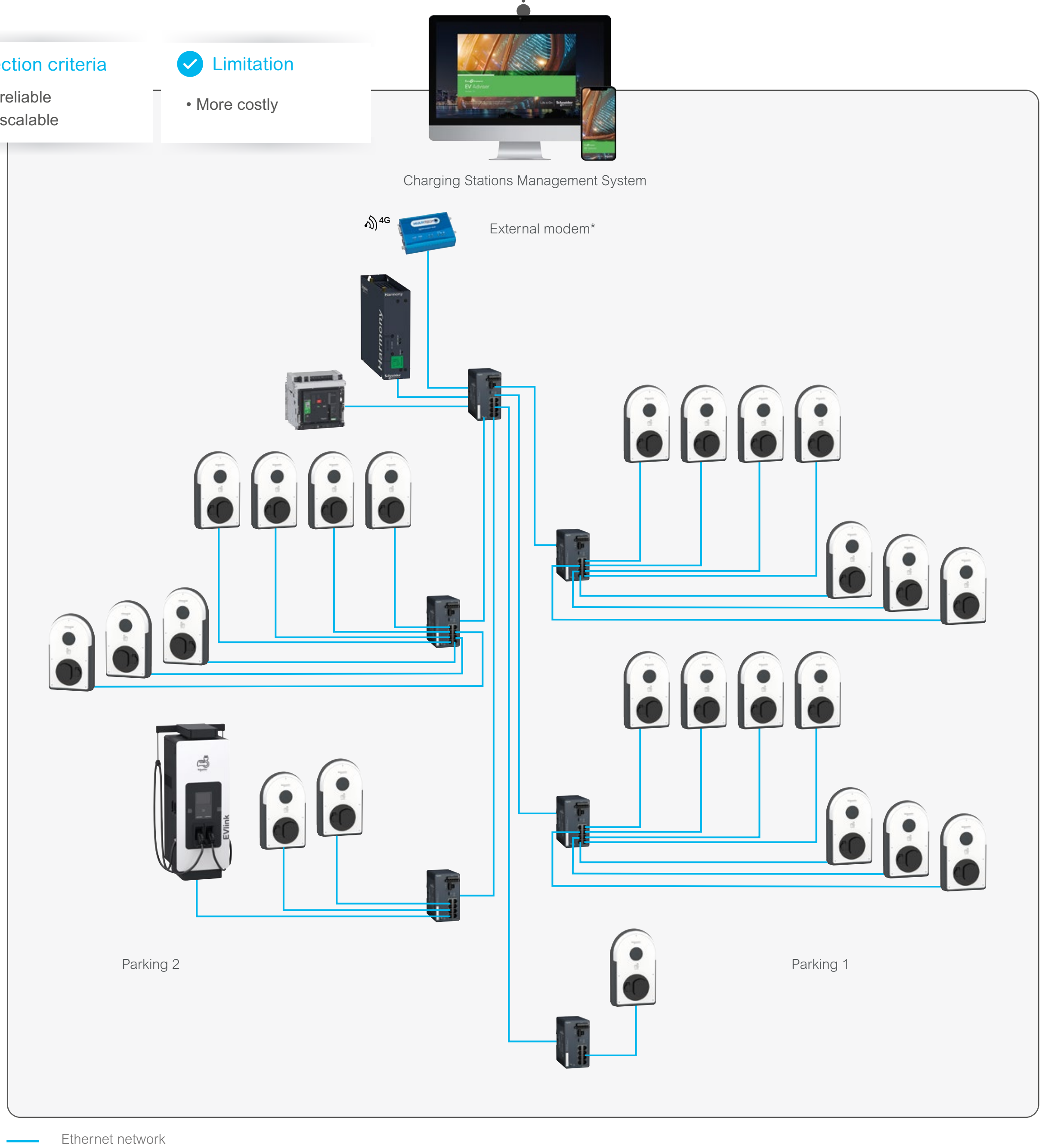
## Zoom-in EV Charging operations enabling one-to-one connection



LAN Ethernet star connection option.

**Selection criteria**
- More reliable
- More scalable

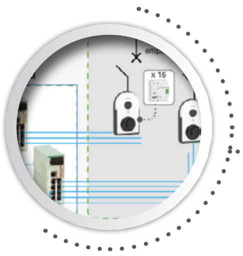
**Limitation**
- More costly




*Up to 100 charging stations for 1 external modem.

# Reference architecture for office buildings

## Zoom-in EV Charging operations optimizing Ethernet network infrastructure



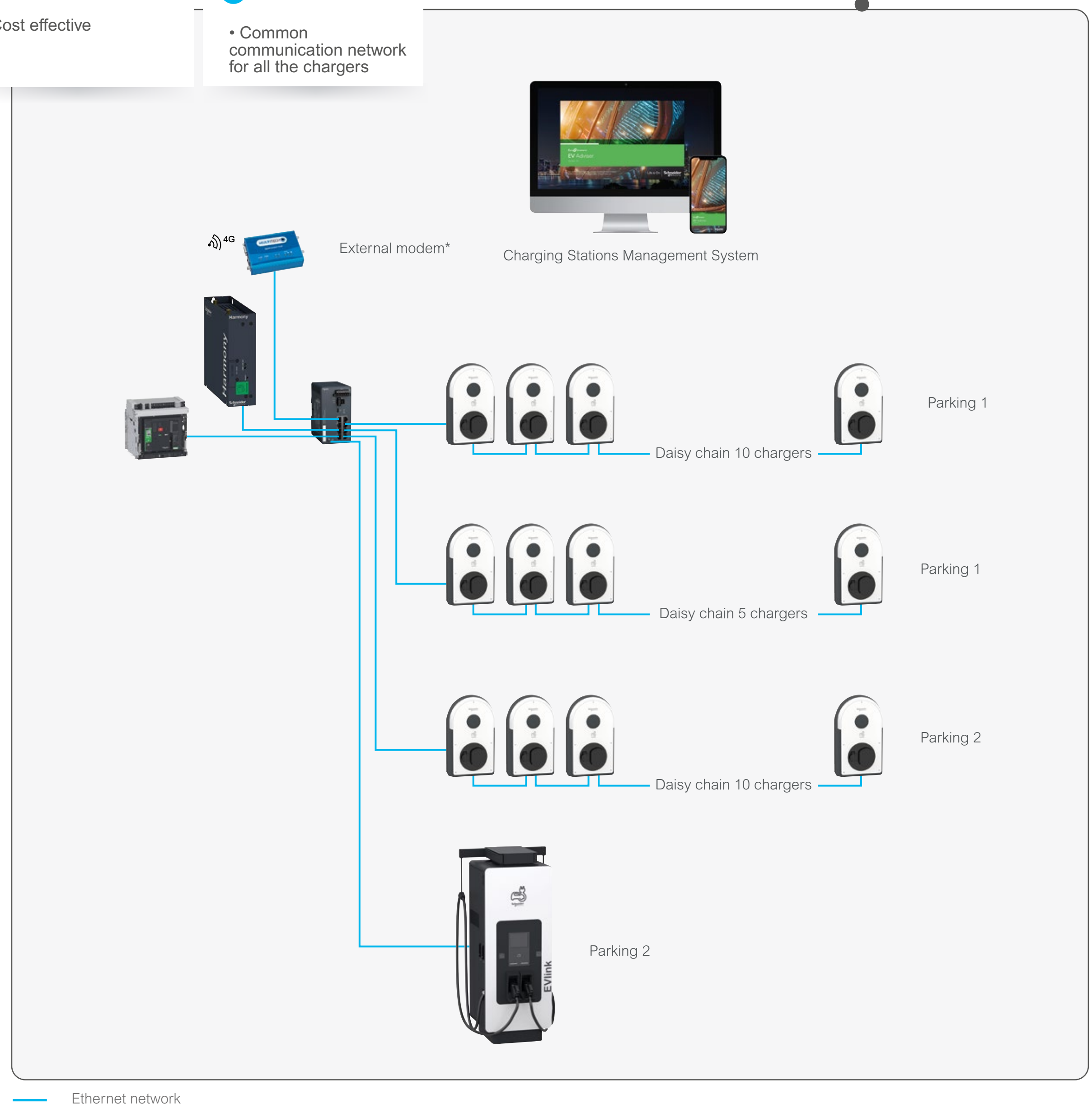
> LAN Ethernet Daisy chain connection (WAN 4G external modem to Charging Station Management System).

**Selection criteria**

- Cost effective

**Limitation**

- Common communication network for all the chargers

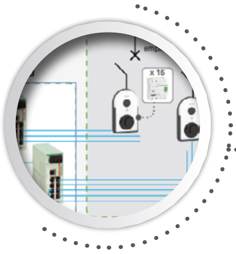



*Up to 100 charging stations for 1 external modem.

# Reference architecture for office buildings

Zoom-in

## EV Charging operations optimizing Ethernet network infrastructure



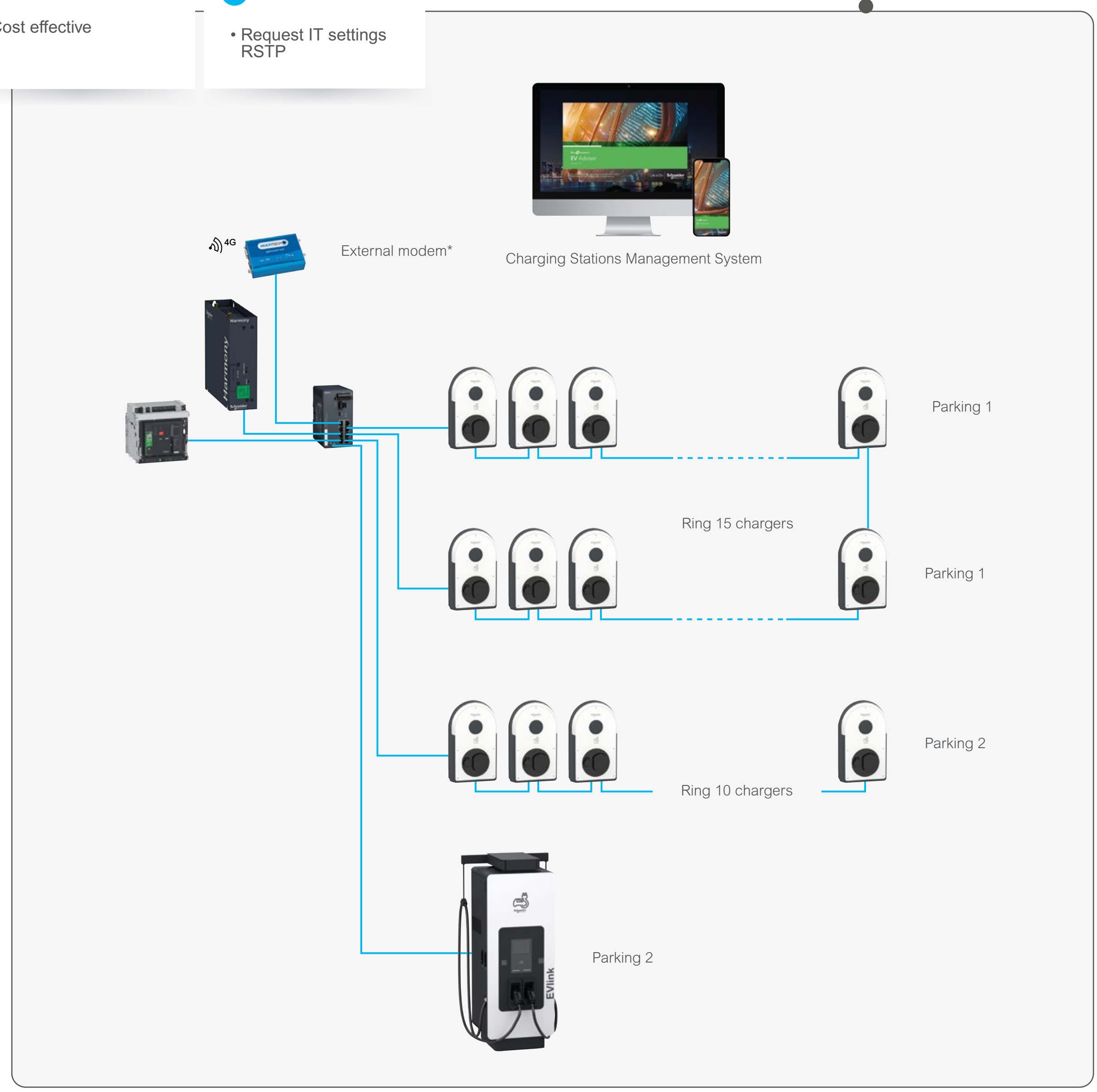
LAN Ethernet ring connection (WAN 4G external modem to Charging Station Management System).

**Selection criteria**

- Cost effective

**Limitation**

- Request IT settings RSTP



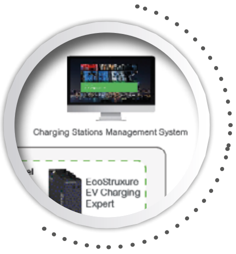

Ethernet network

*Up to 100 charging stations for 1 external modem.

# Reference architecture for office buildings

**Zoom-in**

## Integration of EV Charging operation into Energy and Power Management Systems using REST API




Charging stations: operations managed by Charge Point Operator.
EV Energy and assets managed thanks to EcoStruxure Power Monitoring Expert.

### Selection criteria

- Monitor zones and chargers data in EcoStruxure Power Monitoring Expert
- Limit power dedicated to each zone according to facility overall load and consumption

### Limitation

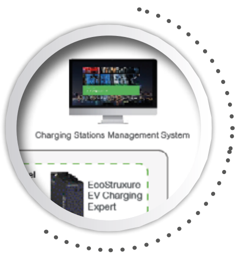
- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Power Monitoring Expert Ethernet network (requires IT management)


Ethernet network
REST API
OCPP

# Reference architecture for office buildings

## Zoom-in

## EV Charging operations operations into Energy and Power Management Systems using MODBUS TCP



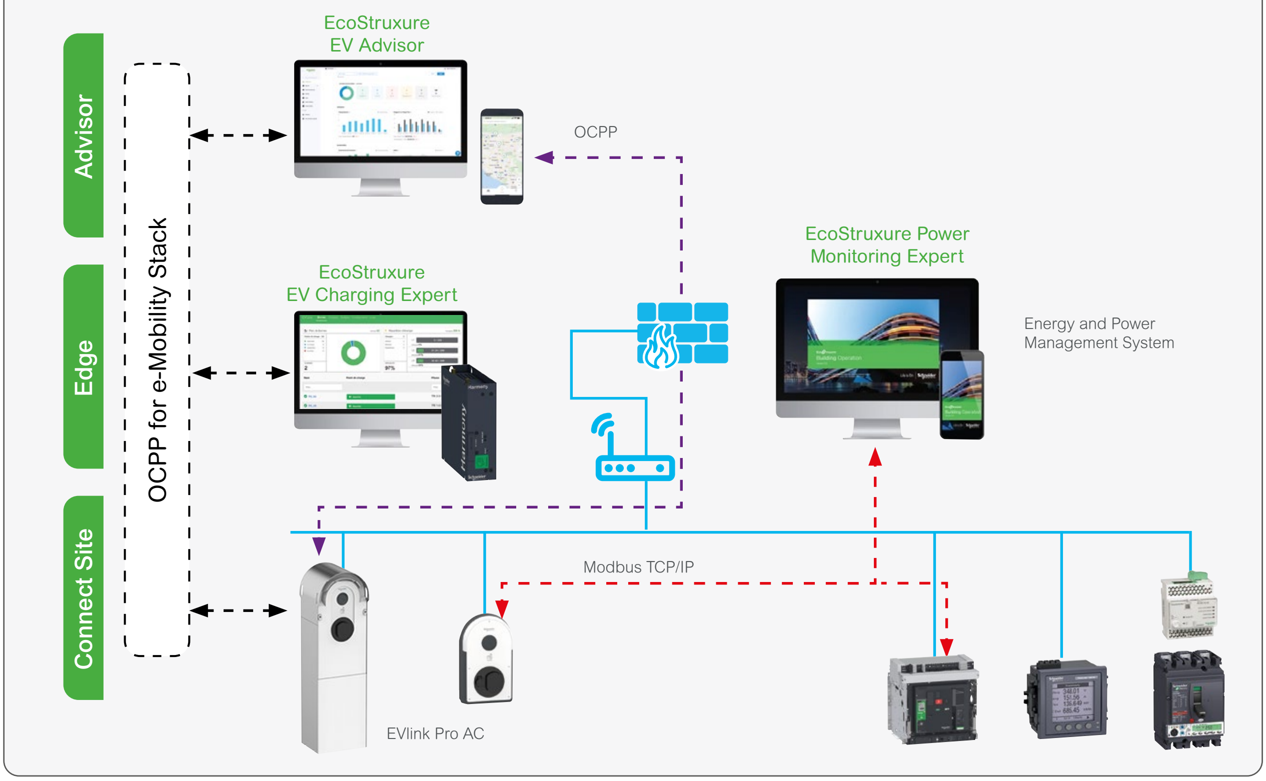

Charging stations: operations managed by Charge Point Operator.
EV Energy and assets managed thanks to EcoStruxure Power Monitoring Expert.

### Selection criteria

- Monitor each charger in EcoStruxure Power Monitoring Expert
- EcoStruxure EV Charging Expert is optional in this architecture

### Limitation

- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Power Monitoring Expert Ethernet network (requires IT management)
- Engineering and commissioning time for EcoStruxure Power Monitoring Expert to integrate devices
- When EcoStruxure EV Charging Expert is present, it is not possible to change the available state of EV charger through EcoStruxure Power Monitoring Expert.

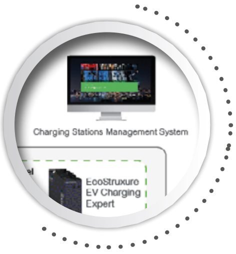



Ethernet network
Modbus TCP/IP
OCPP

# Reference architecture for office buildings

**Zoom-in**

## Integration of EV Charging operations into Microgrid Management System using REST API



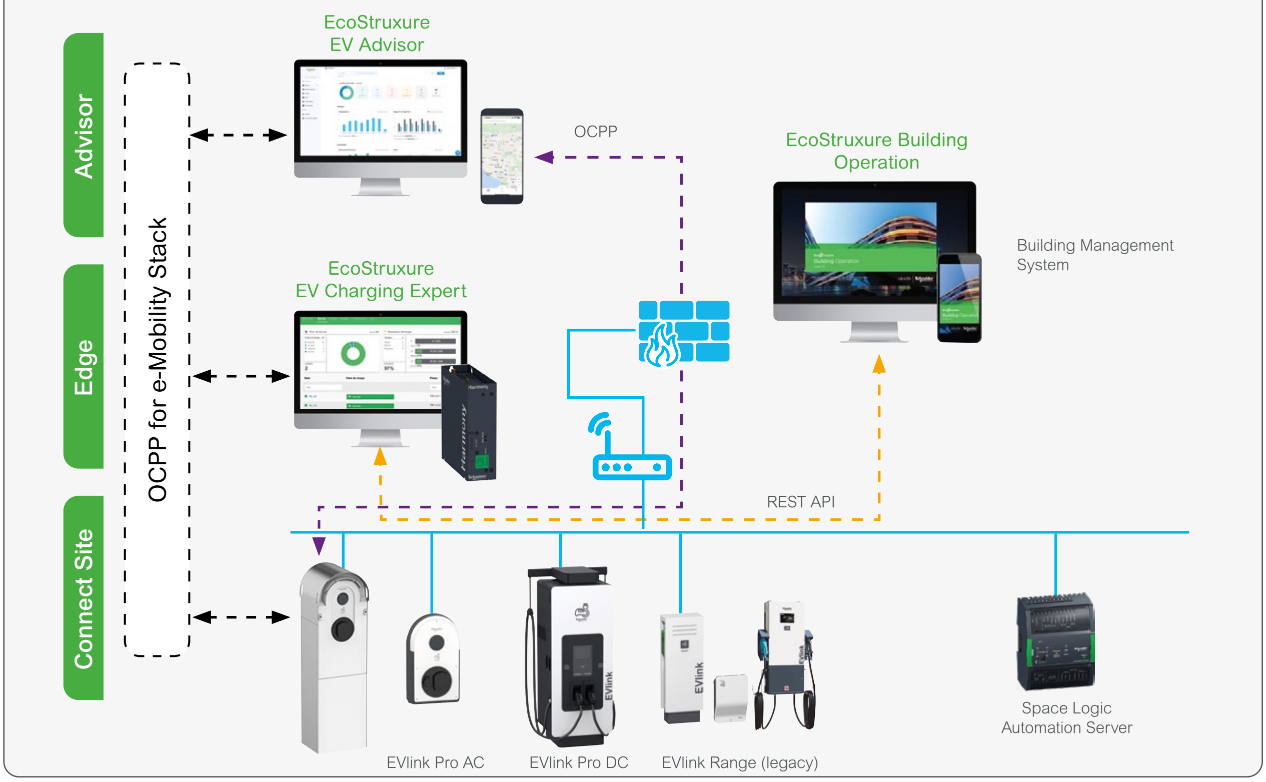

> Charging stations: operations managed by Charge Point Operator.
> EV Energy and assets managed thanks to EcoStruxure Building Operation

**Selection criteria**

- Access zones overview and detailed AC/DC chargers data in EcoStruxure Building Operation

**Limitation**

- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Building Operation Ethernet network (requires IT management)

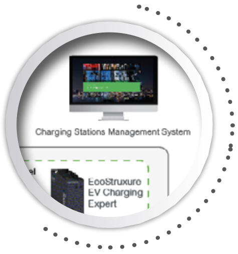



Ethernet network
REST API
OCPP

1 2 3 4 5

# Reference architecture for office buildings

## Zoom-in Integration of EV Charging operations into Building Management Systems using MODBUS TCP



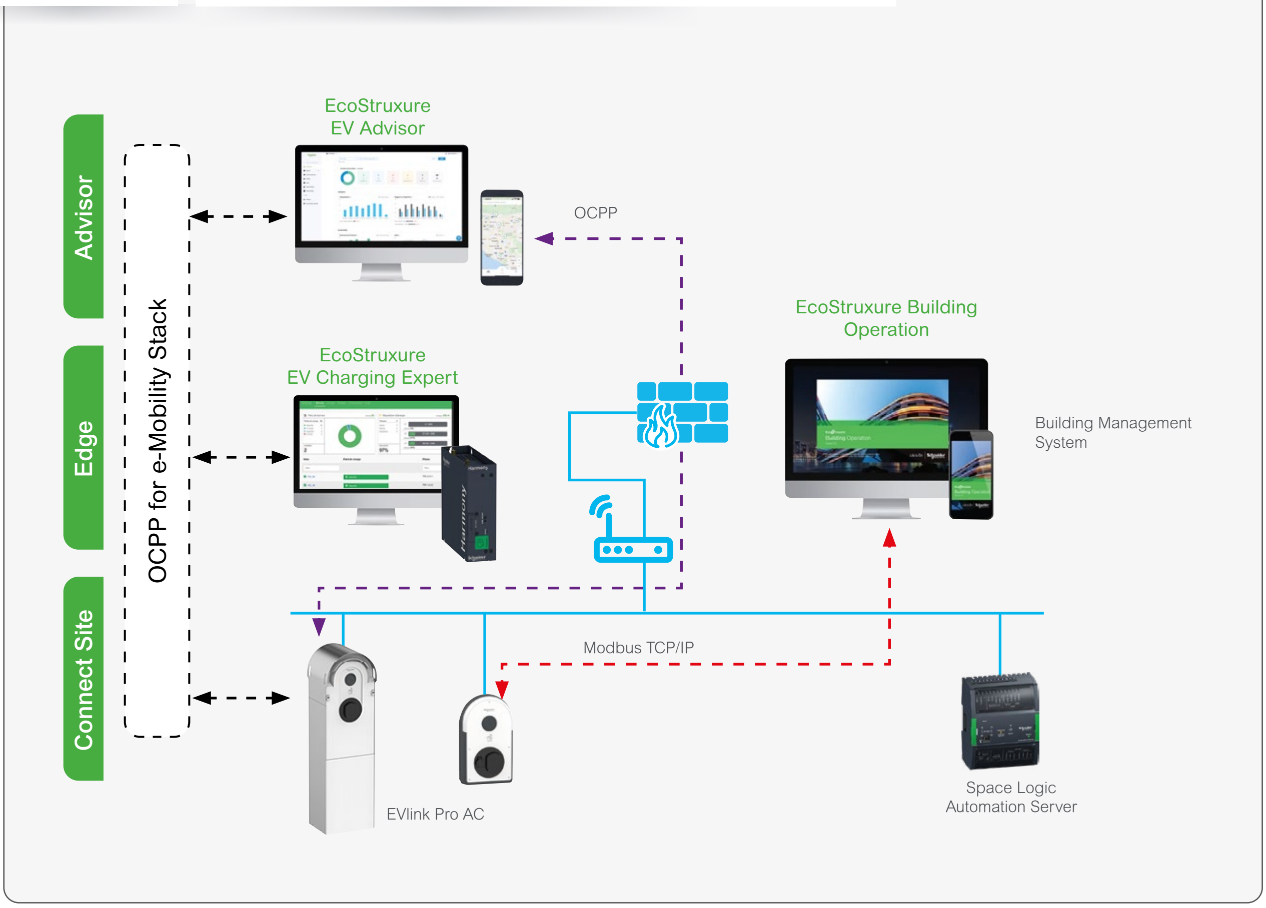

> Charging stations: operations managed by Charge Point Operator.
EV Energy and assets managed thanks to EcoStruxure Building Operation.

### Selection criteria

- Monitor each charger in EcoStruxure Building Operation
- EcoStruxure EV Charging Expert is optional in this architecture

### Limitation

- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Building Operation Ethernet network (requires IT management)
- Engineering and commissioning time for EcoStruxure Building Operation to integrate devices
- When EcoStruxure EV Charging Expert is present, it is not possible to change the available state of EV charger through EcoStruxure Power Monitoring Expert.

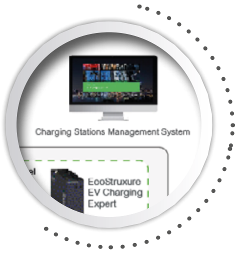



Ethernet network
Modbus TCP/IP
OCPP

# Reference architecture for office buildings

**Zoom-in**

## Integration of EV Charging operations into Microgrid Management System using REST API



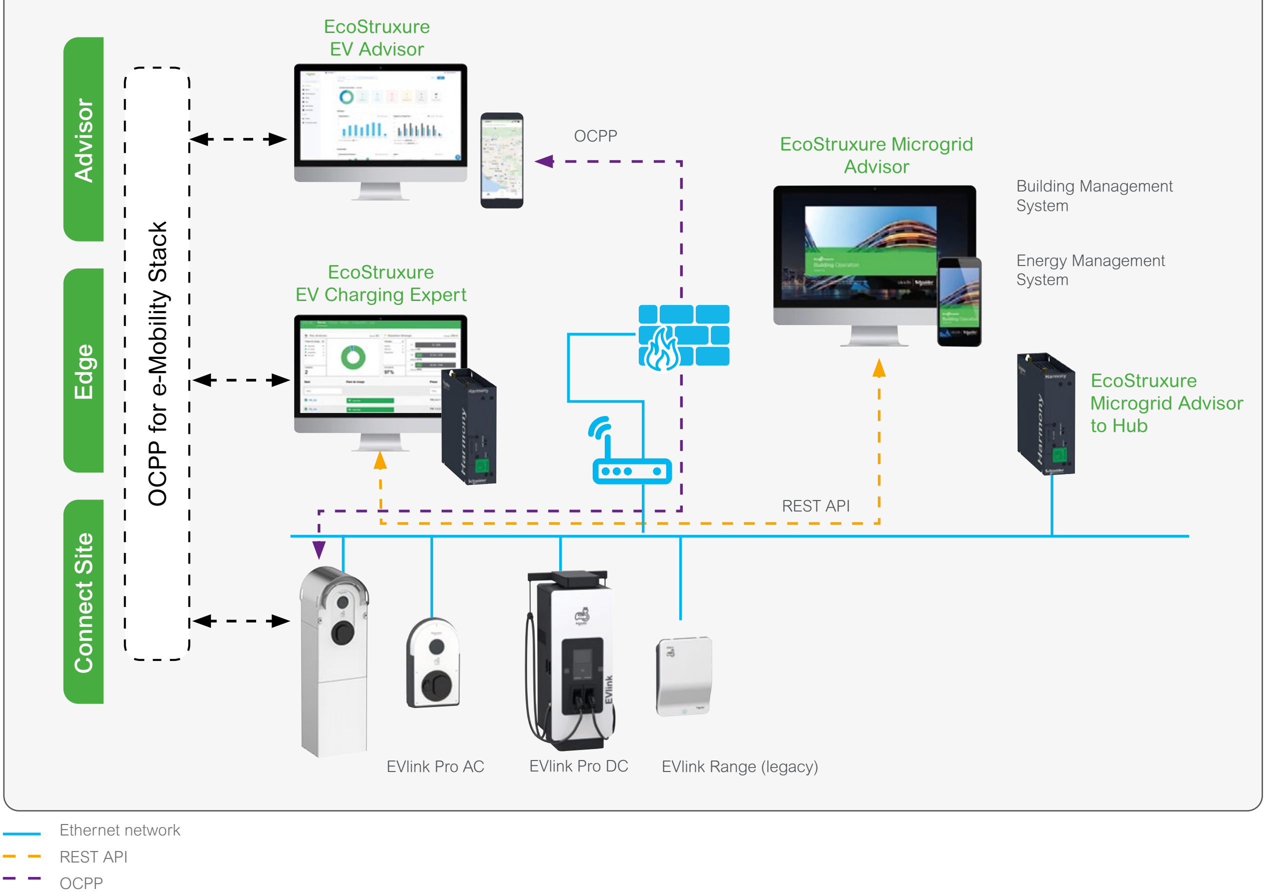

> Charging stations: operations managed by Charge Point Operator.
Energy setpoints of the EV infrastructure managed by EcoStruxure Microgrid Advisor.

### Selection criteria

- EcoStruxure EV Charging Expert integrated with EcoStruxure Microgrid Advisor via REST API
- Zones Setpoint monitoring and control from EcoStruxure Microgrid Advisor

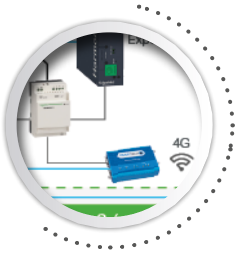
### Limitation

- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Microgrid Advisor Ethernet network



# Reference architecture for office buildings

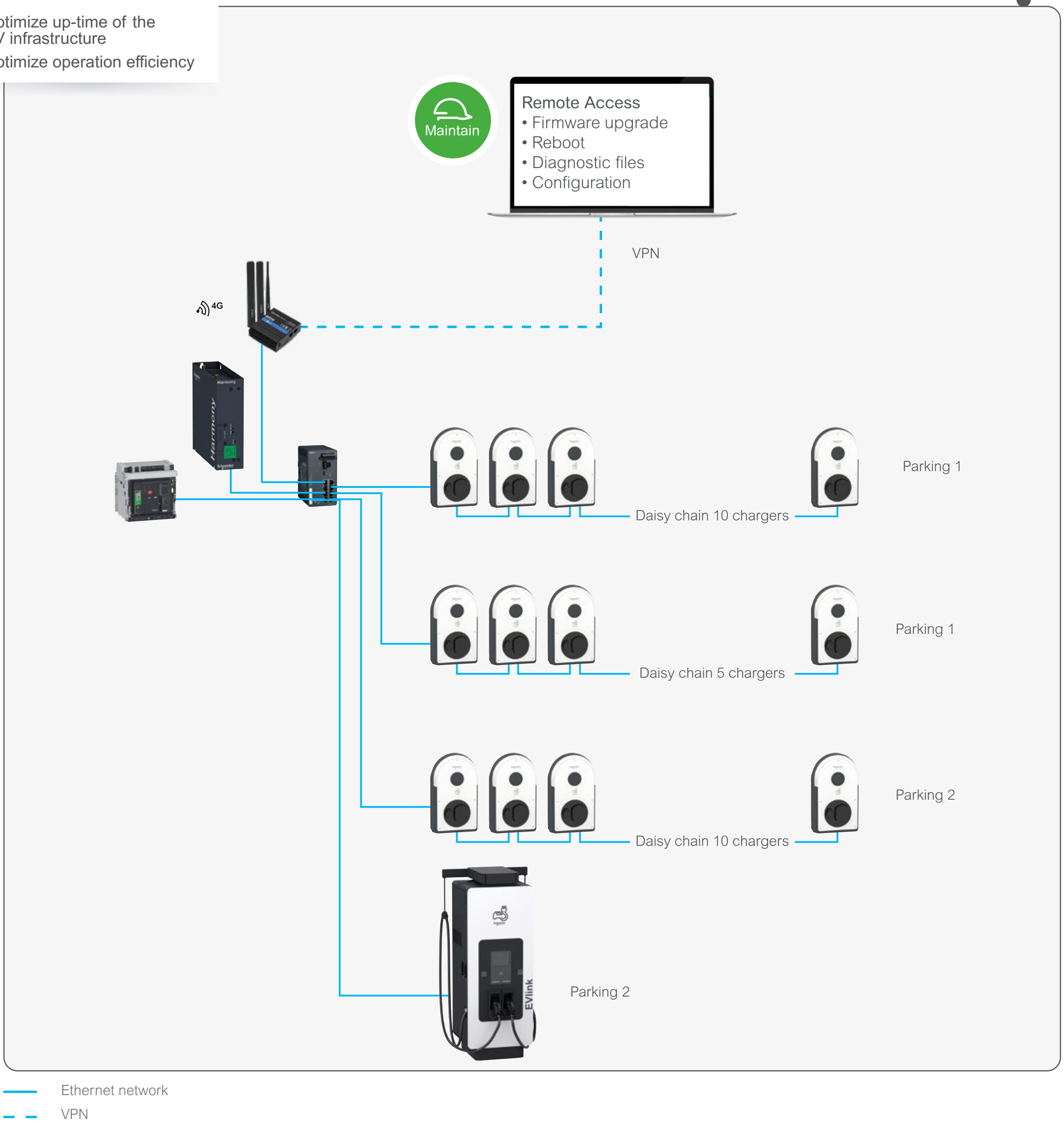
## Zoom-in Alternative enabling remote services




> Provide cybersecured access to a service provider, that allows remote and on-demand access for EV charging infrastructure troubleshooting, maintenance and firmware upgrade.

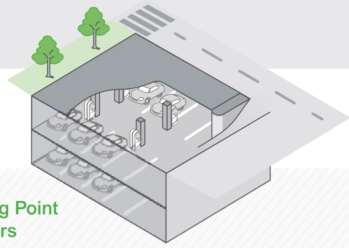
Selection criteria

- Optimize up-time of the EV infrastructure
- Optimize operation efficiency




Note: for remote access offer, contact your Schneider Electric Solution Center.

# Reference architecture for car parks



## Design inputs

Car park owners

Charging Point Operators

**1.Usages**
- Car parks with 2 floors
- Customer car park charging service
- 25 AC chargers per floor
- Payment by credit card

**2.Electrical Distribution**
- Canalis electrical distribution with plug-in tap-off for circuit breaker and RCD* protection
- MID meters installed in charging stations

**3.Power managment strategy**
- Optimizing power availability across the chargers and between the charging infrastructure and the other loads in the building

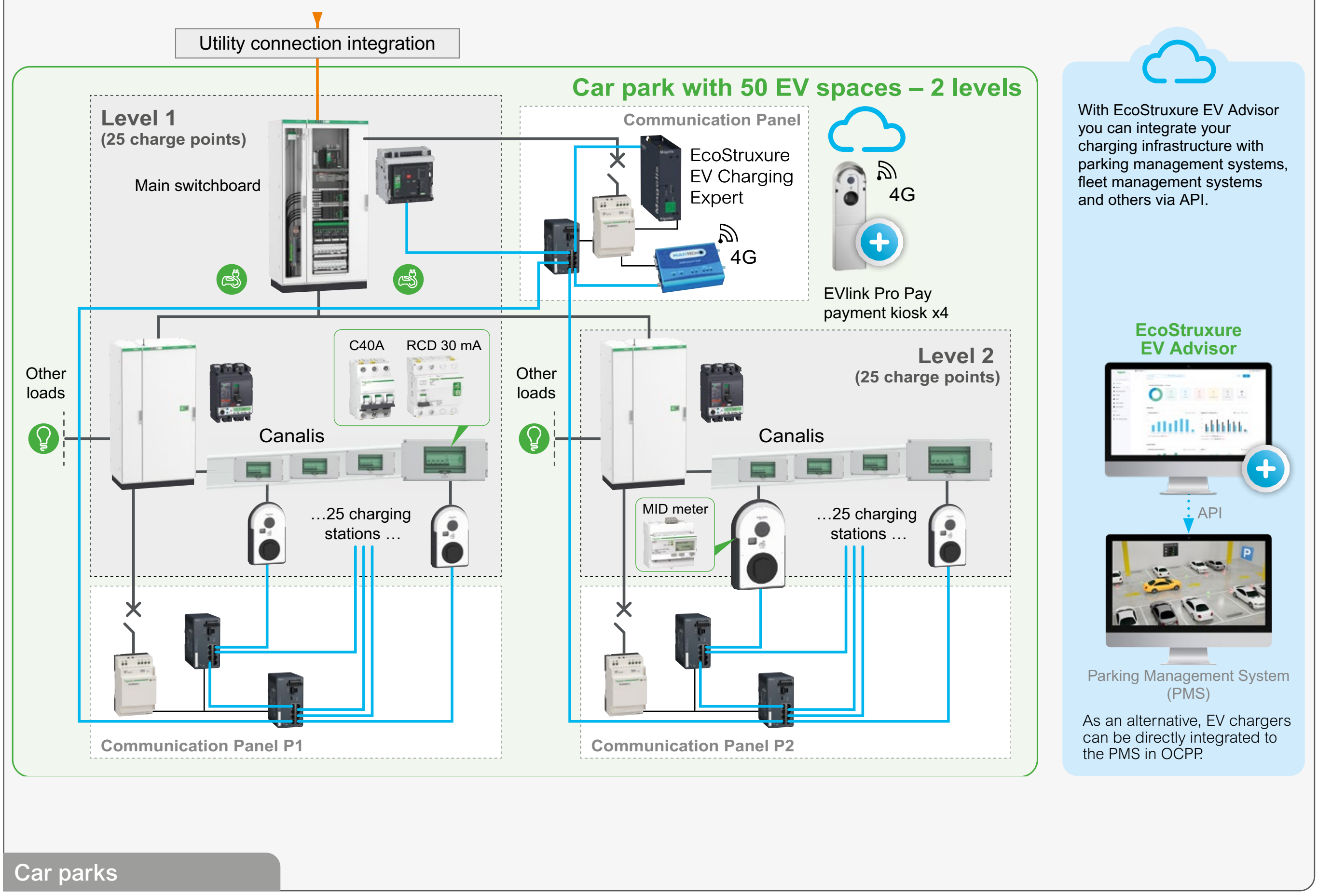
**4.Operational needs**
- Chargers operated by a CPO
- EV charging infrastructure accessible in the parking management system for additional EV driver services



## Reference architecture

**Selection criteria**
- Scalability of the power distribution with optimized costs
- Power supply stability
- Services for EV drivers

**Limitation**
- EcoStruxure EV Advisor is required for integration with the parking management system
- Up to 100 charge points via EcoStruxure EV Charging Expert




Utility network
Power network
24 VDC
Ethernet network

*In countries where the installation standard IEC/HD 60364-7-722 or equivalent local regulations are applied, a RCD type B must be used instead of RCD type A-Si.

# Reference architecture for car parks

## Zoom-in EVlink Pro Pay payment kiosk

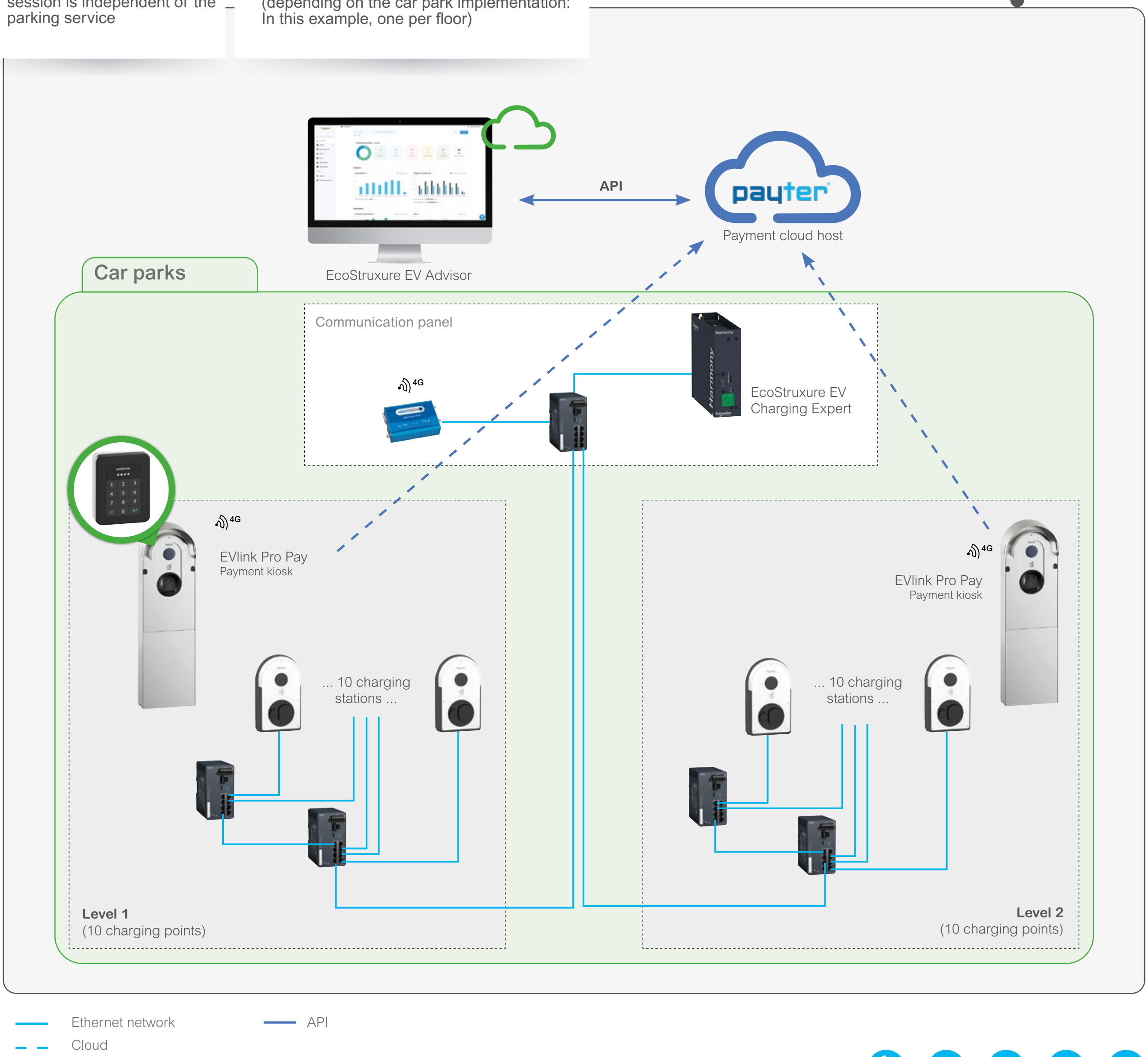

With this architecture, EV drivers can pay for their charging session directly via a payment terminal

**Selection criteria**

- Payment for the charging session is independent of the parking service

**Limitation**

- One payment terminal for multiple chargers (depending on the car park implementation: In this example, one per floor)




1 2 3 4 5

# Reference architecture for car parks

## Zoom-in Parking Management system integration

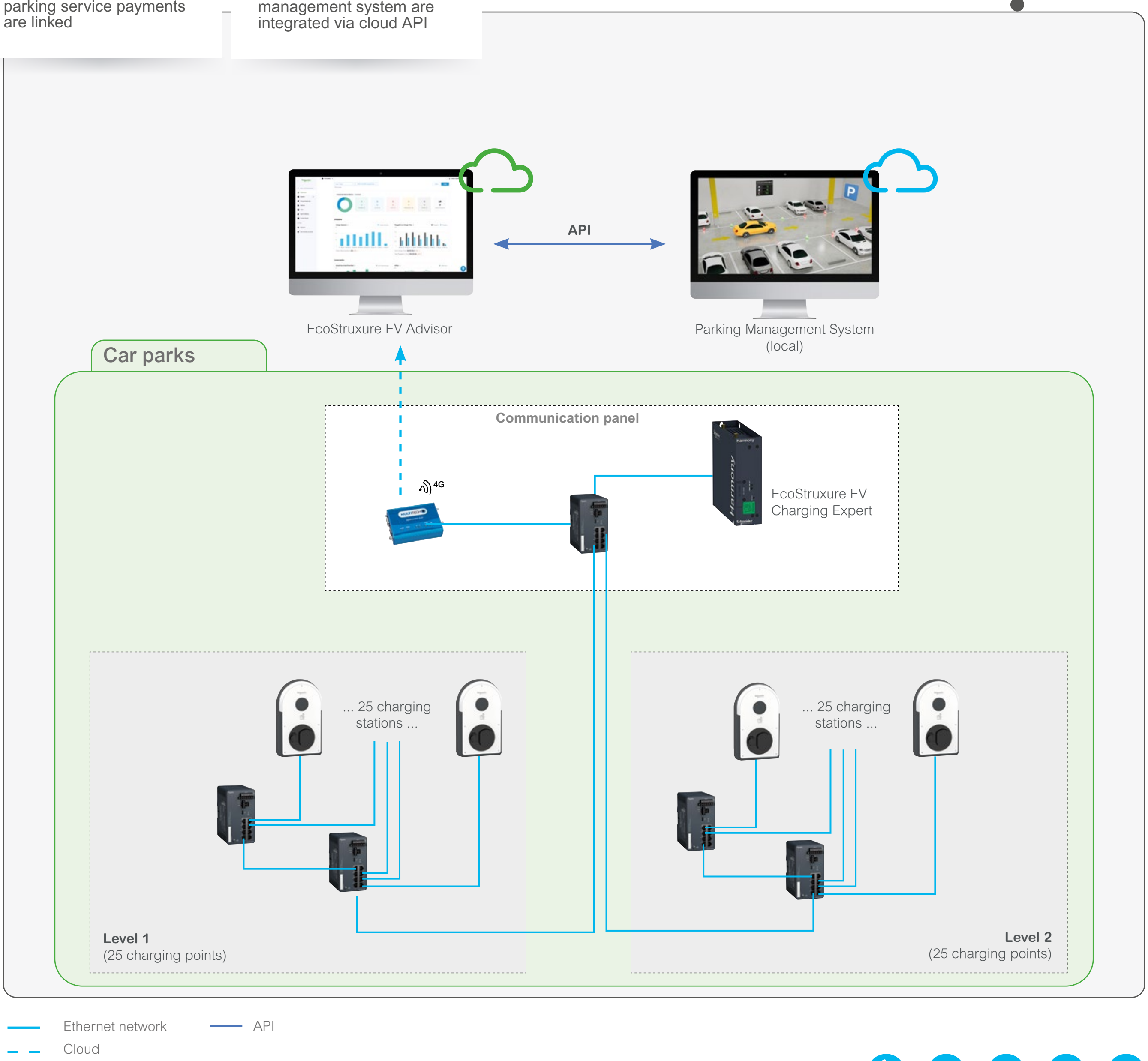
This architecture enables EV drivers to pay for charging sessions and parking services in a single transaction.

**Selection criteria**

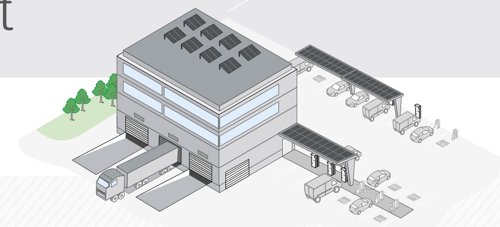
- The charging session and parking service payments are linked

**Limitation**

- EV system and Parking management system are integrated via cloud API



# Reference architecture for fleet depot



## Design inputs

Fleet managers

Building owners/managers

### 1.Usages

- Light Commercial Vehicle depot
- 2 outdoor charging areas
- 5 AC chargers (22 kW) and 5 ultra-fast DC charger

### 2.Electrical Distribution

- For AC: Canalis electrical distribution with plug-in tap-off for circuit breaker and RCD* protection for AC, MID meters and RCDs* installed in the charging stations
- For DC electrical distribution: Outdoor switchgear PanelSet

### 3.Power managment strategy

- Optimizing power availability across the chargers and between the EV infrastructure and the building loads

### 4.Operational needs

- Chargers managed by in-house operators and fleet manager

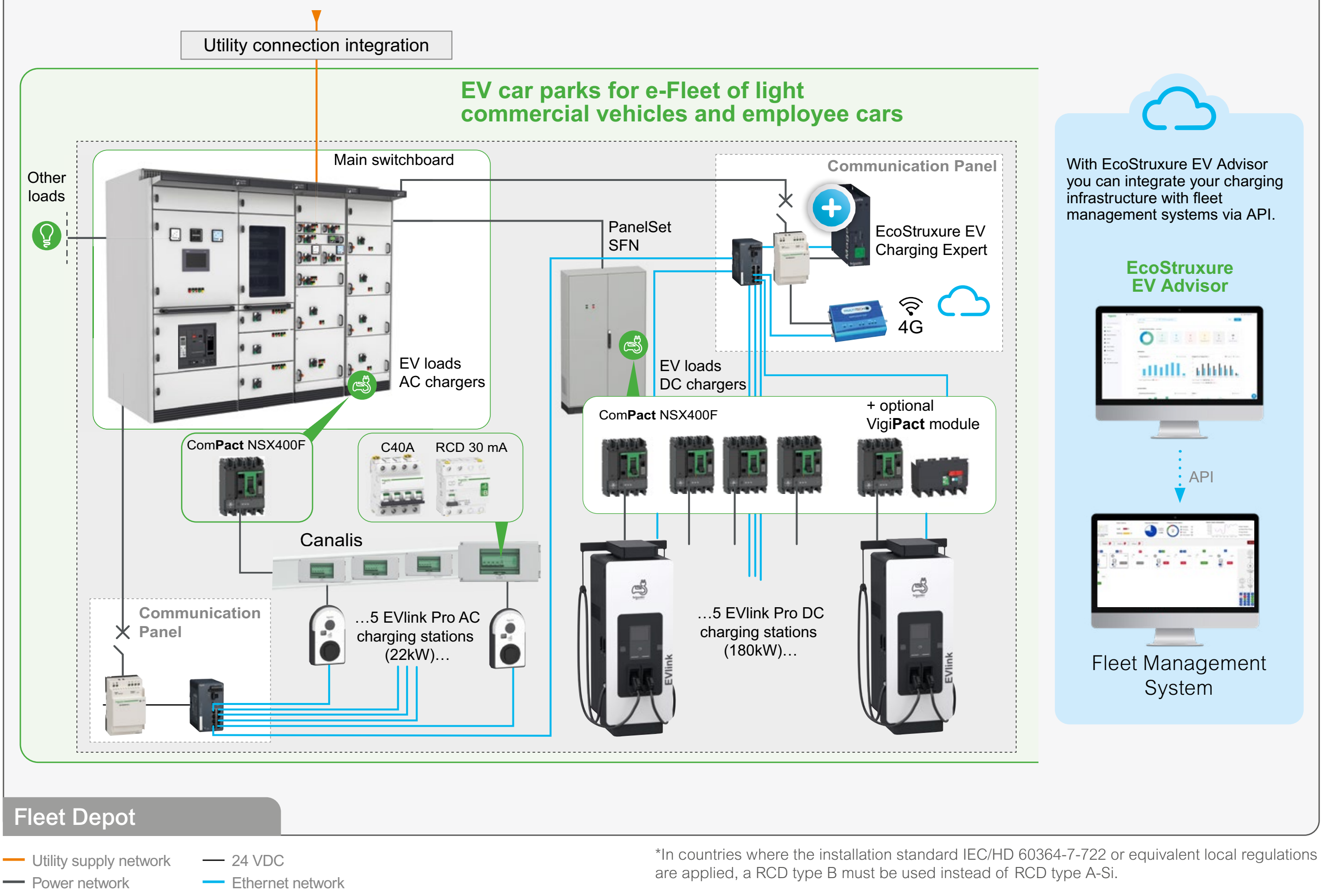
## Reference architecture

**Selection criteria**

- One-stop shop/full line-up of chargers
- Power availability
- Uptime maximization

**Limitation**

- EcoStruxure EV Advisor must be interfaced with the Fleet Management System
- Up to 100 CMs by EVCE




*In countries where the installation standard IEC/HD 60364-7-722 or equivalent local regulations are applied, a RCD type B must be used instead of RCD type A-Si.

# Reference architecture for fleet depot

## Zoom-in Power Management system integration

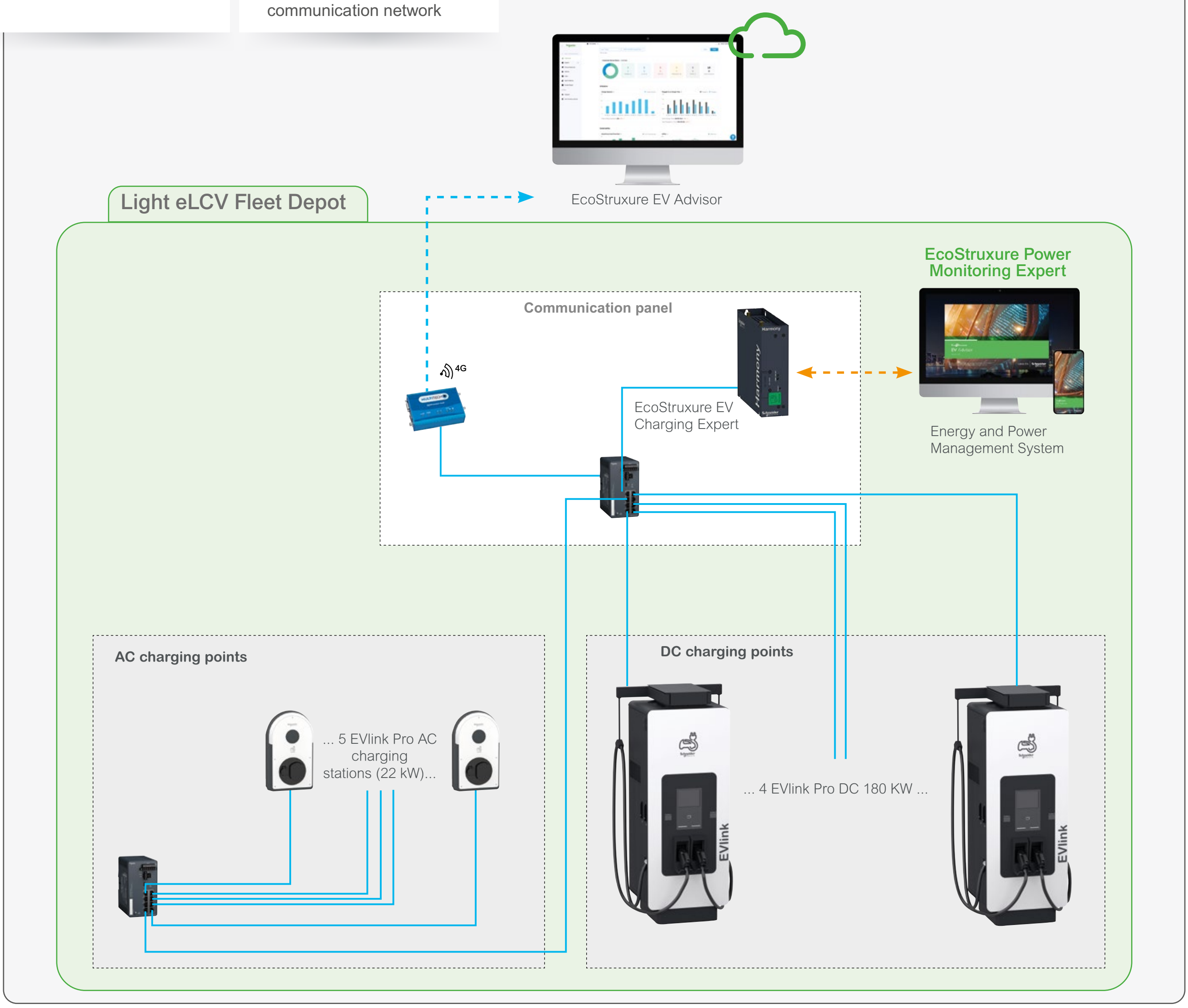
This architecture enables integration of the EV system with the on-site EcoStruxure Power Monitoring Expert.

**Selection criteria**

- Local on-site integration

**Limitation**

- EV loads and other loads shall be on the same communication network




Ethernet network

Cloud

EcoStruxure Power Monitoring Expert REST API, web service interface

# Annexes

## Schneider Electric's policy

Schneider Electric's cybersecurity management policy supports customers by addressing vulnerabilities that can impact products. The company collaborates with researchers, Cyber Emergency Response Teams (CERTs), and asset owners to enable information to be provided promptly to protect as much as possible the installation.

Schneider Electric's Corporate Product CERT (CPCERT) is responsible for managing product-related vulnerabilities, mitigations and issuing alerts.

**Managing cybersecurity for our range of products and services and complying with data privacy regulation are integral to Schneider Electric's business strategy, with publicity and operational results in day-to-day activities.**

### Managing Data Privacy


Data is the lifeblood of our Digital Ecosytems. To govern and protect it, Schneider Electric commits to create, ingest and consume data applying a holistic Data Risk Management framework, anticipating and complying with regulations and managing potential exposures.

Data privacy process:
- Adopt a Data Risk Management Framework (covering privacy, retention, protection, access management, etc.)
- Deploy Data Assurance by design
- Run compliance controls and implement corrective programs as needed
- Hold suppliers and partners to standards of Data Risk Management

### Managing Product Development


To support product development and maintenance, Schneider Electric follows a Secure Development Lifecycle (SDL) compliant with the IEC 62443-4-1 Security Standard for Industrial Automation and Control systems.

Secure Development Lifecycle process:
- Delivering security training
- Security requirements based on risk analysis, standards and regulations
- Conducting Threat modeling and Architecture reviews
- Software security scanning
- Implementing white and black box testing
- Managing security updates with release notes
- Vulnerability management process with coordinated disclosure

# Ressources

## Technical guides

Earth fault protection - Design Guide
**CA908066E**

EcoStruxure Power - Digital Application for Large Buildings and Critical Facilities
**ESXP2G002EN**

Universal Enclosure General Catalog
**UEMKCAT012ENp**

Cahier Technique n°172
System earthings in LV

## White Papers

Smart charging solutions

Safety measures for Electric Vehicle charging

## Schneider Electric support

Sales support

Customer Care

EVlink Field Services

Schneider Electric Partner Program

## On the web

Wiki - EV charging

Schneider Electric on-line specification tool

Schneider Electric eMobility solutions

Schneider Electric Green Premium

The European Cyber Resilience Act (CRA)

Alternative Fuels Infrastructure Regulations (AFIR)

Schneider Electric Cybersecurity support portal

EcoStruxure EV Charging Expert - Solar Impulse Mark

EV Ready certification

# Green Premium™

## An industry leading portfolio of offers delivering sustainable value

Green Premium™

More than 75% of our product sales offer superior transparency on the material content, regulatory information and environmental impact of our products:

- RoHS compliance
- REACh substance information
- Industry leading # of PEP's*
- Circularity instructions

Discover what we mean by green

Check your products!

The Green Premium program stands for our commitment to deliver customer valued sustainable performance. It has been upgraded with recognized environmental claims and extended to cover all offers including Products, Services and Solutions.

### $CO_2$ and P&L impact through… Resource Performance

Green Premium brings improved resource efficiency throughout an asset's lifecycle. This includes efficient use of energy and natural resources, along with the minimization of $CO_2$ emissions.

### Cost of ownership optimization through… Circular Performance

We're helping our customers optimize the total cost of ownership of their assets. To do this, we provide IoT-enabled solutions, as well as upgrade, repair, retrofit, and remanufacture services.

### Peace of mind through… Well-being Performance

Green Premium products are RoHS and REACh compliant. We're going beyond regulatory compliance with step-by-step substitution of certain materials and substances from our products.

### Improved sales through… Differentiation

Green Premium delivers strong value propositions through third-party labels and services. By collaborating with third-party organizations we can support our customers in meeting their sustainability goals such as green building certifications.

*PEP: Product Environmental Profile (i.e. Environmental Product Declaration)

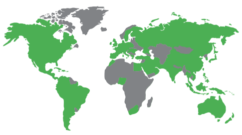

# EcoXpert™ Partner Program

## The Implementation Arms of EcoStruxure™ all over the World

EcoStruxure™
Innovation At Every Level

## Who Are the EcoXperts?

An EcoXpert™ is a Schneider Electric **partner company** that is **trained and certified on EcoStruxure™**, our open, interoperable, IoT-enabled system architecture and platform.



**A worldwide certified network delivering local support**
More than **4,000** EcoXpert partners in **74** countries

**Cross-expertise knowledge**
11 competency certifications (badges) available, distributed in:
- Building and Residential Automation (5 badges)
- Power Distribution and Management (5 badges)
- Services (1 badge)

5-star recognition in CRN's 2020 Partner Program Guide

## Why Call On an EcoXpert Partner?

- **Set the optimized solution and minimize costs** thanks to segment specialized partners
- **Receive lifetime support** for your products and projects (design, engineering, installation and maintenance phases)

One Program. One Network. Endless Opportunities.

Discover our EcoXpert program

Find the right partner to support your project

**Schneider Electric Industries SAS**
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CS 30323
92506 Rueil Malmaison Cedex
France
RCS Nanterre 954 503 439
Share capital €2,268,274,220
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As standards, specifications, and designs change from time to time,
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